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MYOTOMIA REFORMATA:

OR AN

ANATOMICAL
TREATISE

ON THE

MUSCLES

OF THE

HUMAN BODY.

Illustrated with FIGURES after the LIFE.

By the late Mr. WILLIAM COWPER,
Surgeon, and Fellow of the Royal Society.

To which is prefix'd

An INTRODUCTION

CONCERNING

MUSCULAR MOTION.

LONDON:

Printed for ROBERT KNAPLOCK, and WILLIAM and JOHN INNYS,
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ADVERTISEMENT.

IT is a Matter of no Importance to the Publick, to be acquainted with the Reasons why the printing of this Work has been delayed for so long a time as thirteen Years since the Death of the Author; but the Reader may expect to be informed in what Condition it was left by Mr. COWPER, and by what Care and Pains it has been brought into the Form, in which it now appears.

THE Author had finished the Plates of this Book a little before his Death, and was preparing to put in order the Text, when he found his Weakness, occasioned by frequent Fits of an Asthma, which had brought him into a Dropsy, to grow upon him so fast, that he should not be able to complete his Design. He therefore resolved to retire and end his Days in the Country, having first delivered his Papers into my Hands, and desired me, with the Assistance of his intimate Friend Mr. JOSEPH TANNER, an ingenious Anatomist and skilful Surgeon, to take Care of the Publication of his Book.

THE Method Mr. COWPER had taken in this Work was to put down from time to time, in an interleav'd Copy of the Treatise he formerly published on the Muscles, such Alterations and Additions as he thought proper. But it required a finishing Hand to connect and digest all these into right Order: This Task has been performed by the learned Dr. JURIN, Secretary to the Royal Society, who thought himself obliged to preserve not only the Meaning, but also, as much as was possible, the Words of the Author; although Mr. COWPER had always greater Regard to the Truth of his Descriptions, than to the easiness and Politeness of his Style.

THE Author's Preface ends abruptly, and is otherwise defective; for besides the Additions, which are here made to the Preface of his former Book, he intended some others; particularly there were found in his Papers a few Sketches concerning the Usefulness of Anatomy in Painting and Statuary; but these were so imperfect, that they were not fit to be printed.

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T H E Introduction concerning Muscular Motion is not the same with that, which was prefixed to the former Book; though Care has been taken here to preserve whatever Discovery in Anatomy was contained in that. Mr. COWPER was so sensible of the Defects of his own Performance on that Head, that he engaged me to get something more full substituted in its room. I have been enabled to make good this my Promise, by the Assistance of my Friend Dr. H. PEMBERTON, who is no less skill'd in Mathematicks and Philosophy, than in Anatomy and whatever relates to the Animal Oeconomy.

A S the Character of Mr. COWPER, who was universally allowed to be as eminent an Anatomist as any of his Time, will sufficiently recommend this Work, so I am persuaded it may be said to have lost nothing by the other Hands, through which it has passed: And certainly it will be no small Satisfaction to all who may have a Concern for the Memory of the Author, that although this Work has been long expected, yet nothing has in all this time appeared, which can render it less useful or acceptable to the Publick: The Knowledge of the Human Body is indeed a large Field, which doubtless will continually reward the Labour of those, who cultivate it, with the Pleasure of new Discoveries; and some Improvements have been lately made in relation to the Muscles; but no Book, that I know of, has in any Language been yet publish'd on this part of Anatomy, that is so complete as this Treatise; not but that this, like all other human Performances, may have its Imperfections, which will perhaps entertain the ill Nature of such Readers, who take more Pleasure in finding Faults, than they do in being instructed.

Dec. 30. 1723.

RICHARD MEAD.



THE P R E F A C E.



*I*N the Contemplation of Nature we meet with nothing that affords us a more invincible Argument of the Wisdom of the Divine Architect, than the Structure and Composition of Animal Bodies; nor is this Infinite Understanding less manifested in the Instruments of Voluntary Motion, than in any other Parts whatever of the Animal Body.

NO wonder therefore, that Anatomical Disquisitions should be exceedingly entertaining; but besides it behoves Philosophers, who inquire into the Nature of Things, and Physicians especially,

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whose Province it is to preserve the Curious Fabric of the Human Body, to acquaint themselves fully with the Nature and Constitution of that Noble Subject; for that is the only way to learn what are the secret Springs by which the mysterious Operations of Sense and Motion are performed, to discover by the Symptoms of Diseases the several Causes and Seats of them, together with the proper Methods for their Prevention and Cure.

WHAT Esteem the Judicious have always had for Enquiries of this nature, we may learn from our Great Master HIPPOCRATES, who was sent for to DEMOCRITUS the Founder of the Mechanical Philosophy, to cure him of his supposed Madness; and finding DEMOCRITUS dissecting the Bodies of Animals to discover the Seat of the Bile, and assign the Reasons of its Effects, HIPPOCRATES was so far from looking upon him to be mad, that he pronounced him one of the Wisest of Men.

NOR is the Story that is told of our Modern Philosopher DES CARTES less remarkable, who shew'd a Gentleman, that came to see his Library, nothing but a Calf, which he design'd to dissect.

BUT it is needless at this time to enlarge either upon the Usefulness of Anatomy in general, or the particular Advantages of an Exact Knowledge of Myology, in order to the Practice of Chirurgery; and therefore I shall wave what might be said upon those Heads, and only give a short History of the Advancements that have been made in Muscular Anatomy in several Ages, and the Reasons why I undertook to write upon that Subject.

WITHOUT doubt HIPPOCRATES was well skill'd in Anatomy, as appears by his Book De Fracturis, &c.

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ARISTOTLE dissected many Animals before he began to compose their History ; and DIOGENES LAERTIUS, in his Life of this Philosopher, informs us, that he writ also a Treatise of Anatomy, tho' it be now lost.

RUFFUS EPHESIUS had also made some Progress herein, and gave the External Parts their proper Names.

GALEN and the Anatomists of his time were indefatigable in their Anatomical Labours, as appears not only from those excellent Books of his Of Anatomical Administration, and Of the Use of the Parts ; but in that compendious System of the Muscles collected out of them by ORIBASIUS. After GALEN we find no considerable Progress made in Anatomy, till the Accurate JACOBUS SYLVIVS and ANDREAS VESALIUS, about the middle of the sixteenth Century.

THERE were indeed, even before GALEN, others who wrote of Anatomy, as ALCMÆUS CROTONIATA, DIOCLES CHARYSTIUS, ERASISTRATUS, and HEROPHILUS, of which the two latter are said to have taught Anatomy publickly, and to have dissected many hundreds of Human Bodies in Greece, Syria and Ægypt. GALEN was a Disciple of the last ; but we have none of their Writings now extant. Besides these there are others mentioned by GALEN, as LYCUS, QUINTUS, who was LYCUS'S Master, MARIANUS, and others ; but we shall not repeat any more of their Names, since their Observations afford us no occasion to mention them hereafter.

MANY Arabians have also written on this Subject, of whom AVICENNA is esteemed the chief.

SINCE the Restoration of Letters, MUNDINUS is reckon'd the first Anatomist, whose Works are commented on by JACOBUS BERENGARIUS CARPENSIS, and CURTIUS ; but neither of these furnish us with any Discoveries in Myology.

GABRIEL

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GABRIEL DE ZERBIS *is also mentioned, but his Writings are mostly collected from the Observations of others.*

NICOLAUS MASSA, *a Physician of Venice, not only writ an accurate and compendious Introduction to Anatomy, so far as it was known in his Time; but being himself a Dissector of human Bodies, he corrected some Errors of former Anatomists.*

STEPHANUS RIVERIUS, *a Chirurgeon, made several Drawings of the Parts of human Bodies, he dissected; which were put forth by CAROLUS STEPHANUS, a Physician, with three Books of his own, in Folio, in the Year 1545, some time after the excellent Figures of VESALIUS had been published; but as these Figures, by reason of their great Stiffness, are no wise to be compared with those of VESALIUS, so we learn from the Preface, that they were drawn, before those others had seen the light, viz. in the Year 1539.*

JACOBUS SYLVIUS *was an accurate Anatomist of his Time: He wrote an admirable Commentary on GALEN'S Book Of the Bones, and likewise against VESALIUS, in defence of HIPPOCRATES and GALEN. After his Death was published that incomparable Piece entituled Isagoge Anatomica, wherein he digested the Muscles and Vessels into order, which were treated of confusedly before by GALEN, VESALIUS, COLUMBUS, and FALLOPPIUS, and distinguished them by those Names that are still in use.*

BEFORE SYLVIUS, *or at the same time, FERNELIUS and JOHANNES GUNTHERUS ANDERNACUS were Contemporaries; but neither of them have made any Improvements in the Knowledge of the Muscles.*

ANDREAS VESALIUS *began very young to examine the Parts of several Animals, in which Study by a wonderful*
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Sagacity and Peculiarity of Genius, he made a swift and successful Progress. He was Scholar to GUNTHERUS, as we learn from two Treatises of the latter, viz. his Institution. Anatom. and his Book de Veteri & Nova Medicina; and a Disciple to SYLVIVS, as is acknowledged in the Preface to his first Impression De Fabrica Humani Corporis, printed in the Year 1543, which Passage is left out in the second, published in the Year 1555. And here it may not be amiss to take notice by the by of another difference between these two Editions, to wit, that the Figures of the former are much finer, but the Descriptions are more correct in the latter.

INDEED much is owing to this Great Man, whose Accounts of the Muscles as well as of all other Parts, that were known to him, are generally very faithfully delivered. He was Cotemporary with REALDUS COLUMBUS, GABRIEL FALLOPPIUS, BARTHOLOMÆUS EUSTACHIUS, and VALVERDA, all excellent Anatomists, especially the three former; the first of which and CÆSALPINUS started early Hints of their Knowledge of the Circulation of the Blood; which perhaps for some Reasons they afterwards concealed.

FALLOPPIUS was a most accurate Dissector of the Muscles, and was no mean Admirer of VESALIUS, tho' he made several Corrections of his Descriptions of the Muscles and other Parts, discovering several things that had escap'd that great Man's Observation.

FROM these the Myology has received its greatest Improvements; and tho' there are divers others who have written on this Subject, yet none except HIERONYMUS FABRICIVS AB AQUAPENDENTE, and JULIVS CASSERIUS PLACENTINVS, have given any true Marks of their Knowledge herein.

BOTH the RIOLANS Pretensions are great; but we trace them in FALLOPPIUS.

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THERE are divers others in repute with the Vulgar for their Descriptions of the Muscles, amongst which SPIGELIUS is the chief; but there seems to be nothing extraordinary in his Book, besides the Figures of JULIUS CASSERIUS PLACENTINUS, some of which are very ill done. Since our last named Author, there has been nothing discover'd in Myotomy, except M. DU VERNY's Oblique Muscle of the Ear.

THE Sculptures of BIDLOO are not to be forgotten, since they express divers Muscles, and other Parts so near the Life.

THE many that have lately written on this Subject, especially our English Writers, have rather increas'd than diminish'd former Errors; and particularly that Treatise of Mr. WILLIAM MOLINS, and that most erroneous one of JOHN BROWN, are chiefly Collections of the Mistakes of others.

THE greatest part of Books now extant are mere Copies, or Extracts, and useless Rhapsodies. Originals are few and rare; Mankind finding it much easier to transcribe and steal, than to invent and improve, though Nature affords an unexhaustible and yet hidden Treasure, sufficient to employ the Search and Industry of all the Hands and Wits in the World. One great Mistake has much obstructed the Advancement of true Knowledge, and that is a general Opinion, that the Senses are gross and ignoble, and that abstracted Contemplations are the Perfections of Human Nature; and so it comes to pass that Man's Mind is fed and pleased with Chimæra's and Shadows, instead of true substantial Knowledge, which is only to be learnt from the true Physical Examination of things by Sense and Experiment.

IN the former Edition I gave the Figures of a few Muscles only, being either such as had not been before discovered, or at least not well express'd, in the Figures of VESALIUS, CASSERIUS and other Authors: In this you have all the Muscles hitherto describ'd drawn in situ, with some Muscles I have discover'd since
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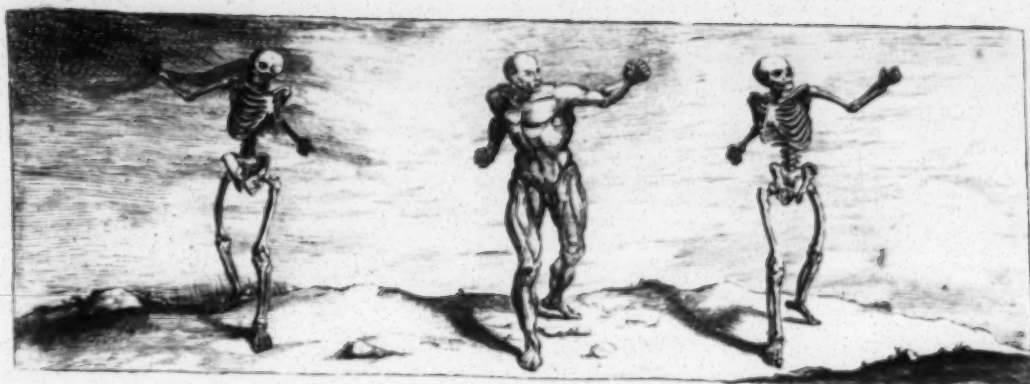
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the Publication of the former Edition. The Outlines of some of these Figures are drawn after RAFAEL, Sir PETER PAUL RUBENS, GUIDO RENI, MONS. LE FAGE; but the Muscling is done after several Human Subjects, and not copied from any Anatomical Book whatever. All these Figures are engrav'd on Copper, and where the Parts they represent are very small, there is a prickt Line continued from such Parts of the Figure, to which the Characters or Arithmetical Numbers are affixed, that refer to the Explications; by which is avoided Confusion on those Plates. You'll sometimes find the same External Muscles represented in several Figures, but always in different Positions; and this I think cannot be unacceptable to some, whatever others may say of its being needless. That the External Muscles are oftener the Subject of our Consideration than the Internal, is sufficiently known. Wherefore we cannot be over curious in representing them in various Positions. But besides the exact Knowledge of the External Parts, that's required in the Practice of Surgery, I am apt to think those who bend their Studies to the admirable Arts of Sculpture and Painting, may receive some Hints at least from these Anatomical Figures.

BESIDES the Figures grav'd in Copper, to make the Anatomy as intelligible as I could, I have added Figures of the Muscles, as they appear after Separation from the Body, with their Series of Fibres, as they are seen on their internal Surface. This was attempted by CAROLUS STEPHANUS or rather STEPHANUS RIVERIUS; but with what Success, may be seen by comparing what is there done with the Life.

IN doing these Figures I was not contented to sketch them after Drawings I had made of them in their proper Situation, but from the Muscles themselves after Dissection. And Care is taken, that all those Muscles that are done less than the Life, bear a Proportion to one another: And all those that are express'd as big as the Life have this Mark to them †.

THE Muscles of the Internal Ear only are done bigger than the Life, to make them the more distinctly visible.



INTRODUCTION.

Concerning the

MUSCLES and their ACTION.



S all the Appearances of Nature furnish matter for Speculation worthy of a rational Mind; so those of the Animal Economy more particularly recommend themselves to our Consideration. For the knowledge of the Causes, from whence the various Operations and Changes wrought within our selves do arise, may be of more immediate use, as it may aid us in the discovery of proper means to guard against, or to remedy the many Disorders, the human Body is constantly subject to. But

since the animal Machine is one of the most curious and delicate of all Nature's Productions, that come under our Observation; and consequently to determine the use of its Structure and Parts requiring the greatest Sagacity and Judgment; it is no wonder that the arriving at any tolerable degree of Knowledge in this Subject, has more effectually been prevented by the false Methods of enquiry, that have for many Ages prevailed among Philosophers. Even the gross occult Qualities of the Ancients have hardly given a greater obstruction to the Improvement of this most useful Branch of Science, than the more refined Species of such Qua-

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lities introduced by the Moderns, under the denomination of Hypotheses. The only remedy against this Inconvenience is the same here, as in the other Parts of Philosophy; to lay aside all mysterious and unintelligible forms of Speech, nor any longer to be employed in determining the Operations of Beings, to whose very Existence we are altogether Strangers; but to enquire after such real Causes, as the Phenomena necessarily imply, and to endeavour by a farther search to discover the degree and manner of the Action of those Causes; pursuing these ends by the proper Means of attaining them, which are only Experiments and just Reasonings drawn from Mathematical Principles.

ALTHOUGH the immense Difficulty of this way of proceeding has hitherto prevented great Improvements in this Subject, yet some parts of the animal Body, and some few of its Operations, have been by these Methods successfully searched into. From the time that the invention of the Telescope occasioned the effects of Diaphanous Bodies upon Light carefully to be examined, very considerable advances have been made in the Discovery of the use of the several parts of the Eye, which assist in Vision. And to come nearer to our present Purpose, Mechanicks applied to the Muscles have largely instructed us in their Action. But indeed in these, as well as in every other part of the Body, we have a proof of the Deficiency of our Capacity to penetrate very far into the Secrets of Nature. For notwithstanding we are able exactly to trace the Species of things manifested by Sight to their Impression on the Optick Nerve, and have discovered by what Principles, and by what Mediums, the Images of external Objects are formed in the Eye; yet what effects those Images have on the Nerve, whereby the Perception of the things themselves is caused, remains wholly a Secret to us. In like manner in our present Subject, while we can reduce to rule, and determine the effects of the Muscles upon the Parts they belong to, we continue altogether in doubt concerning the Cause, that puts them in action; both which last Reflections in relation to the Muscles I design in this Discourse particularly to illustrate.

BUT in the first place, it may not be improper to say something of the Muscles in general. These taken at large are perhaps the most immediate Instruments of all the Motions, that are produced in the Body; for it is not improbable that every Coat, Membrane and Fibre thereof, exert their several Motions, by much the same Principle, as those parts do, that have more generally been called Muscles. Amongst these last, some are the Instruments of voluntary, others of involuntary Motion, and others again of a Motion compounded of both these. But we shall here chiefly consider the Instruments of voluntary Motion; for if they be not of themselves the simplest, yet as their Operations are most obvious to us, so we are better acquainted with the manner and degree of their effects on the Parts, their Action is employed about, than with the like Properties of the other sorts. The principal Muscles then, that serve for voluntary Motion, are what chiefly give Substance
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to the Body, and what cloath the Bones of the Trunk and Limbs, with what is called Flesh. This Flesh is not one continued Mass, but is distinguish'd into divers Portions. Each Portion of Flesh is called a Muscle. These Muscles are disposed of in such a proper manner all over the Body, as to conduce to the elegance and beauty of its Structure, as well as to the execution of each particular Muscle's office. Though these Muscles lie in a manner contiguous to one another, yet each of them is separated from the rest, either wholly or in part, by a Membrane proper to it. This Membrane, though very thin, in robust and well fed Bodies is filled with Fat, and in hydropical Subjects charged with Serum.

As the office of these Muscles is to change the Situation of some parts of the Body in respect to others, each Muscle must be annexed to the different Parts, between which its Action is divided. And these are generally the Bones. And whereas upon the ordinary Action of any Muscle, one of the Parts, to which it is annexed, remains more stable, with regard to the Trunk of the Body, than the other; the extremity of the Muscle, annexed to the more stable part, is called either the Head or the Origine of the Muscle, as the other Extremity, inserted into the most moveable part, is called the Tail or Insertion of the Muscle, and the middle part lying betwixt these two, which swells, while the Muscle acts, is called its Belly.

EACH Muscle is made up of two different Parts, distinguished by their Colour, a fleshy part, which appears red, and a tendinous, which is white. These are continuous to one another. The fleshy Parts are composed of divers slender Portions, which are likewise still composed of very fine Fibres, that lie along each other. But of the Structure of the smaller Parts of the Muscles we shall speak more hereafter. These fleshy parts appear furnished with Blood Vessels, Nerves and Lymphaducts.

THE other sort of Fibres, that constitute the Tendons of the Muscles, are more compactly joined together than those of the fleshy Parts; insomuch, that in a human Body there is no appearance to the naked Eye of the Interposition of Blood Vessels, Nerves, or the like; though these may be here discovered by the aid of a Microscope; and may be seen without Magnifying Glasses in the Tendons of larger Animals, in particular in the Tendon of the *Gasterocnemius* Muscle of a Horse.

THE Blood Vessels belonging to the Muscles are Arteries and Veins, with both of which each Muscle is furnished. The first brings to the Muscle Blood from the Heart, which Blood is returned thither again by the Veins. As by this circulating Fluid all parts of the Body are kept in repair, so to it the Muscles owe the redness of their fleshy Fibres, which appear white after frequent washings.

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washings. To the Nerves, the Muscles, as well as the other parts of the Body, owe their Sense, and likewise their Motion.

THESE Blood Vessels, and Nerves, usually enter the Muscle nearer to the Head thereof than to the other Extremity, which has occasioned another Definition of the Head of the Muscle, than that before given, namely, that it is the part, at which the Blood Vessels and Nerves enter; but this is a very imperfect Characteristic to determine this Part of a Muscle, seeing many Muscles have Vessels entering into them in two or three different Parts; and moreover, the present Description joined with the other, that the Head or Origine of a Muscle is its least moveable Part, has given rise to very false reasoning in respect to the use of some Muscles. In particular it has been argued concerning some of the Muscles of the Larynx, that the inferior part of them is the least moveable, by reason that the Nerves enter them at that end; whereas this is no consequence at all: for the fixedness of any part of a Muscle cannot be caused by such tender and flexible Bodies as the Nerves and Blood Vessels, but by the stability of the solid Part, to which it is affixed.

OF the Lymphaducts, which we observed to belong to the Muscles, it will be sufficient just to take notice, that these fine and transparent Vessels receive from the Blood its more limpid Parts; which however proper to be carried off at the places, where these Lymphatics arise, is not a Fluid become wholly useless to the Animal; but is returned again into the Veins; and in its Passage thither mixing with the Chyle, seems to have a particular Use in rendering the alimentary Juice more fluxile, and facilitating its Assimilation with the Blood.

AND this may suffice in general concerning the Structure of the Muscles. But the manner and degree of their Action I design to consider more at large: In order to which, it must be observed, that the Muscles perform their Office by the contraction of their Fibres, that Contraction producing the Decurtation of the whole Muscle. From hence arise two Questions to be discussed, relating to the Action of the Muscles. The one enquires into the Cause of the Contraction of a muscular Fibre; the other, how this Decurtation of the Muscles is conducive to the Production of the several Motions thence arising. The first of these Questions relates chiefly to the use of the Nerves and Blood in the Contraction of the Muscles; and the second has reference to the Situation and Disposition of them in respect of the Parts, they move. These two Questions I shall here treat of separately in two distinct Parts; and as the latter Question falls most easily under Examination, it may conveniently be spoke to in the first place.

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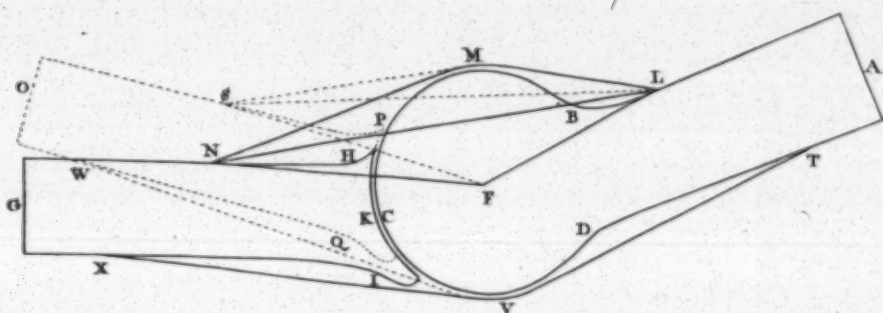
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THE first case, I shall consider, is that of a Muscle appropriated to the Inflection or Extension of a Joint, being connected only to the Bones of that Joint, by each of its Extremities to one of them. Now the Joints are for the most part, in the Limbs especially, a Conjunction of two Bones in the following manner. One of the Bones is terminated in a round Head, approaching either to a spherical or cylindrical Form; which is received by a Cavity, called by Anatomists a *Sinus*, formed in the other Bone of a correspondent Figure, and so received as to be moveable in it; and the Motion will be performed upon the Center of the spherical Head, or upon the Axis of the cylindrical one. When the Heads of the Bones deviate from a regularly spherical or cylindrical Figure, which they are found to do remarkably in some Joints, the Center or Axis of Motion is continually changing, being different in different Flexures of the Joint. But then the Center, or Axis of the Motion may be determined, in any proposed Situation, by finding a Sphere or Cylinder of the same Curvity with the Head of the Bone in that Part, wherein it is in contact with the *Sinus*; which, in this case, it will not be in all its Parts, as when the Head is of a more regular Figure. The superior Head of the Thigh Bone, by which it is joined with the *Os Innominatum*, is the most perfect Example in the Body, of a regularly spherical Figure; and the inferior Head of the *Humerus*, that part of it, which is articulated with the *Ulna* in the Joint of the Elbow, with no less Exactness cylindrical; excepting the circular Indentures made in it, for the more firm Connection of the Joint, which do not anywise influence the Axis of the Motion, they being concentrical to it. Now a Muscle connected by each of its Extremities to one of the Bones, which constitute a Joint, must be more extended in some Angles, which the Bones shall make with each other, than will be required in other Angles; except only when the Muscle is connected to the very Axis of the cylindrical Joint. Hence, when the Muscle exerts its contracting Power, if the Direction in which the Muscle will contract, be not in a right Line passing through the Center or Axis of Motion, it will endeavour to reduce the Joint into that Disposition, wherein the lesser length of the Muscle is required.

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LET $ABCD$ be a Bone, having a round head BCD ; the Center of this Head F , if the Head be spherical; if cylindrical, let the Axis of it pass through F , and be perpendicular to the Plane of this Scheme. Let $GHIK$ be a Bone, having a hollow *Sinus* HKI adapted to the Head BCD ; so as to form a Joint. Let LMN be a Muscle not passing through the point F , nor yet the Axis drawn through F perpendicular to the Plane of this Scheme. Let the Joint be bent, till the Bone



GK be removed into the Situation $OPQO$, and the Muscle obtain the Situation LMS : Then, I say, the Muscle in the Situation LMS is shorter than in the Situation LMN . Draw FL, FN, FS, LN, LS : then in the two Triangles LFN, LFS the Side LF is common to both, and the Sides FN, FS equal, but the Angle under LFN greater than that under LFS ; wherefore the Base LN is greater than the Base LS : And besides, the Angle under FLN is less than that under FLS ; so that the point M is farther distant from the Line LN than from LS . Therefore if the Figure LMS were so applied to the Figure LMN , that the point L remained common to both, and the Line LS fell upon LN , the Line LMS would fall wholly within the Line LMN , though the point S were to fall upon the point N ; but the Lines LMS and LMN would likewise be concave towards the same Part, therefore the Line LMS would be shorter than LMN , though the point S were to fall upon N , and the Line LS were equal to LN , but LS is less than LN ; whence the Line LMS will be still shorter than LMN .

UPON the same Principles the Muscle TVW , on the other side of the Joint, connected to the Bone AC in T , and to the Bone $OPQO$ in W , will be shortened, when the Bone $OPQO$ is restored to the Situation GK , and the Muscle have the Situation TVX .

FROM all this it is evident, by the Principles of Mechanics, that when the Muscle LMN contracts it self, if it lie not directly over the Axis of the Joint's Motion, it will inflect the Joint, drawing the Bone GK towards the Situation $OPQO$; and the Contraction of the Muscle TVW will extend the Joint, by reducing the Bone into its original Situation. By its farther Contraction the Joint will be bent the contrary way, except the form of the Joint, and the Ligaments, by which the Bones are connected, prevent it.

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It is here to be observed, that the Muscles are usually connected to one of the Bones very near the Joint, by which means the Flexors of the Joints are preserved contiguous to the Bones in all their Motions. When both the Extremities of a Muscle are far distant from the Joint, the Muscle is bound down to the Joint by a Ligament. In this case the Method of shewing, how the Inflection of the Joint shortens the Muscle, must be something different from the foregoing: But the principal Alteration required is, that instead of the Line FL , which is common to the two Triangles LFN , LFS , the Line must be taken, which will join the point F , and the place of the Muscle invested by the Ligament; because the distance of the Ligament from that Extremity of the Muscle, connected to the Bone, from which the Ligament takes its rise, remains always near the same.

BUT now this confining of the Muscles down to the Bones answers two very valuable Purposes; one is, that the small degree of Contraction, it was proper to allow the Muscles, may give to the Joints a sufficient Motion; the other, that the Figure of the Limbs may be preserved. But then this consequence on the other hand follows from hence, that the Resistance, which is applied to the Extremity of the moveable Bone of any Joint, and is supported by the Muscles of that Joint, bears but a small proportion to the force required in the sustaining Muscles. In the present Figure, supposing the Bone AC to be fixed, the other GK will perform the Office of the mechanical Power, called the Lever; of which F is the Fulciment, by which it is sustained, N the point to which the moving Power is fixed, acting obliquely in the direction of the right Line NM . If a Resistance be applied to the Extremity of the Bone G , then by the Principles of Mechanics the force of the Muscle, acting in the direction MN , will be to the Resistance in G , when the force of the Muscle and Resistance are in *Æquilibrio*, as the Perpendicular let fall from the point F upon the Line, in whose direction the Resistance in G is applied, to the Perpendicular let fall from the same point F upon the Line MN . For instance, if the Bone GK be held parallel to the Horizon, and a Weight be suspended, by the action of the Muscle LMN , at the Extremity of the Bone G ; because in this case the Direction, in which the Weight resists, is perpendicular to the Bone, the force required in the Muscle LMN to suspend the Weight applied in G will be to that Weight, as the whole distance of the point G from the point F , to the perpendicular let fall from F upon the Line MN .

IN the same manner may be found the Power required in the Muscle to support the Weight of the Limb in any Situation; for that Power of the Muscle will be to the Weight of the Limb, as the Perpendicular let fall from the Center of the Joint upon the Line drawn perpendicular to the Horizon, through the Center of Gravity of the Limb to the Perpendicular let fall from the Center of the Joint upon the part of the Muscle, that lies in the direction of its Action,

BORELLI

BORELLI in his Treatise concerning the Motion of Animals * contends that the force of the Muscle is double to that which is assigned by this Rule. He collects this from the following Assertion, which he takes great pains to demonstrate; That if a String be connected to a Peg, and distended by a Weight hung at it, the Resistance of the String shall be equivalent to double the Weight; or if a Stick be erected perpendicularly upon the Ground, or upon one's Hand, and compressed by a Weight placed upon the upper end of it; the Resistance of the Stick shall be equivalent to double the Weight supported. Though *Borelli* is very large upon this, and has drawn out his Proof into several Propositions; yet all he has advanced seems to me little more than a playing upon Words. The whole of what he says amounts to this, That the Reaction of the Peg, to which the String is fixed, and of the Hand or Ground, which supports the Stick, is equal to the Weight, by which the String is distended, and the Stick compressed; and the String and Stick are affected by both. But may one not with as much Reason say, that the String is distended, and the Stick compressed by the Weight only, because the Weight being removed, the Distension and Compression entirely cease. It is true likewise, if the Peg or Ground be removed, the String will not suffer Tension, nor the Stick be compressed by the Weight connected to them: It may therefore be asked, whether the Tension of the String and Compression of the Stick may not be ascribed to them. And certainly they may; though this being to refer the Effect of an active Power to the Resistance, which supports its Action, the usual manner of speaking favours the other way of expressing it. But if the Stick be supported by the Hand, the Powers applied to both its Extremities are equally active, and the Compression of the Stick may be attributed to either. Yet it is altogether as proper, I think, to say that this Compression is equivalent to one of them only, because if one be removed, the Action of both upon the Stick will cease, and if, in the room of the active Power of the Hand, the Ground which is passive, be substituted, the Compression of the Stick will remain the same; as to say, with *Borelli*, that because whether the Ground or Hand support the Stick, the Compression will not be different, and when the Hand is used, there are applied to the Stick two active equal Forces; therefore when the Ground supports it, its Compression is equivalent to twice the single active force applied to it. The same may be said of the other Method he takes to confirm his Opinion, drawn from the Consideration of a String inflected over a Pulley with an equal Weight hung at each end, the Tension of which will remain the same, if one of the Weights were removed, and the end of the String, to which it was fastened, tied to a Peg. Whence he concludes, that when there is but one Weight, and the other end is fastened to a Peg, the Resistance of the String may be said to be equivalent to twice that single Weight, because the String is stretched as much by that, as it is, when the other Weight equal to the first is hung to the end before tied to the Peg. But may it not as well be said, that the Resistance or Tension of the String is

* De Motu Animal. Par. I. c. 10.

equivalent

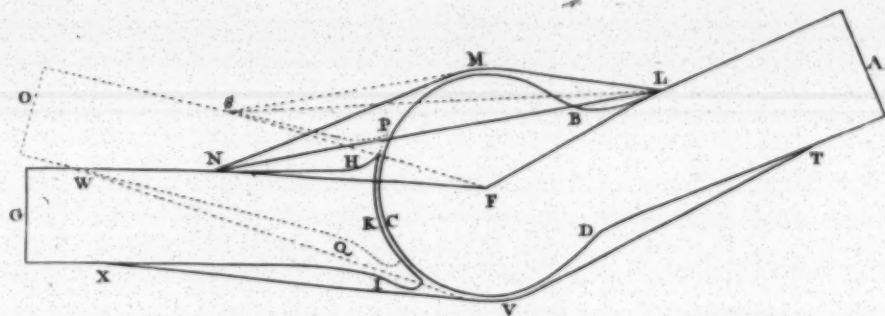
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equivalent to one of the Weights only, when two are tied to the String, because the presence of the other Weight is necessary in order for the action of one of them; and if one be removed, and its place be supplied by a Peg, the Tension of the String will be no greater in the former Case than in the latter? Certainly these two different ways of Expression amount only to this, that according to *Borelli* you affirm the String to be distended as much by one Weight as by both; in the other way you affirm the String to be no more distended by both the Weights than by one.

BUT now if this be so, that *Borelli* does only dispute for an uncommon manner of Expression, while the same thing is signified, as by the usual way of speaking, I should chuse to keep to that; since that can hardly draw us into any Error, which the other may, if we are not very carefully attentive to the Idea signified by it; for it has actually misled *Borelli* himself, as will hereafter appear.

THUS much of computing the Force, with which the Muscles act, that lie over one Joint. It next follows to shew how to determine the Direction of their Action; which is easily deducible from what has been said. For in the Figure it is evident that the Direction, in which the Muscle *LMN* acts, will be always according to the Line *MN*, which denotes the part of the Muscle lying over the Joint, and



out of contact with the Bones; whatever the Position be of the part *LM*, included between the point *M*, where the Muscle leaves the Bone *AC* in order to pass over the Joint, and the Point *L*, its Connection with the same Bone.

SEVERAL Muscles lie very oblique to the Direction, in which they act; tho' none, perhaps, more than the Muscles of the Foot. From which an Instance or two taken will sufficiently illustrate the Rule here laid down. To mention in the first place the *Peroneus primus* or *longus*, in which neither its Body, nor all that part of its Tendon from the *Os Cuboides*, under which it is inflected to its Insertion into the innermost Bone of the *Metatarsus* supporting the great Toe, is direct to its Action. The Tendon especially lies very remarkably oblique; the action of this Muscle being not very different from that of the *Peroneus secundus*.

c

I am

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I am therefore surprized that *Riolan* * should ascribe to the first of these Muscles, which he calls *Peroneus posticus*, the Office of extending the Foot; and to the other, the *Peroneus secundus*, called by him *Anticus*, the contrary Office of bending it: For their Tendons lie contiguous upon the hinder and inferior part of the *Fibula*, and remain so during their Inflection under the outer Ankle, till the Tendon of the *Peroneus secundus*, which is the exterior one, is inserted into the external part of the Root of the outermost Bone of the *Metatarsus*; and the other Tendon, at the same time inflected under the *Os Cuboides*, in a *Sinus* of which it is included by a Ligament, as it passes to its Insertion. And by the Rule just now laid down, that part only of the Tendon of the *Peroneus secundus* between the outer Ankle, and its Insertion, lies in the direction of its Action; and that part only of the Tendon of the *Peroneus primus* from the outer Ankle to its Inflection under the *Os Cuboides* lies in the Direction, in which that Muscle acts. Which evidently shews both these Muscles to give the Foot almost the same oblique Motion; the principal difference is, that the *Peroneus primus* does something more extend the Foot; the Root of the outermost Bone of the *Metatarsus* by the one, and the *Os Cuboides*, which supports the internal part of the Root of that outermost Bone of the *Metatarsus*, by the Action of the other will be moved nearly in the same Direction, that is to say, upwards and backward. They both conspire with the Extenders of the Foot in raising the Body, in walking, upon the Ball of the great Toe. It appears therefore from what has been said, that the Action of the *Peroneus primus*, of which we undertook principally to speak, is the same, as if its Tendon were connected to the *Os Cuboides*. Though the carrying this Tendon across the Foot, and inserting it into the Bone of the *Metatarsus*, which supports the great Toe, answers a very considerable End: For the Junctures of the Bones of the *Tarsus* are more effectually strengthened and secured by this Contrivance, than if a Ligament of equal Strength had connected the *Os Cuboides* and innermost Bone of the *Metatarsus* together.

THE *Tibialis posticus* affords another Instance of a Muscle, whose greatest part lies oblique to its Action; that being in the Direction of the Part of its Tendon, between the Inflection of it under the inner Ankle, and its Insertion; to which the whole Body of the Muscle lies very oblique. The use of this Muscle is to enable the Extenders of the Foot, by acting in conjunction with them, to raise the Body upon the Balls of the lesser Toes; an Action which in walking we are obliged to perform, as often as the inner part of the Foot has received any hurt.

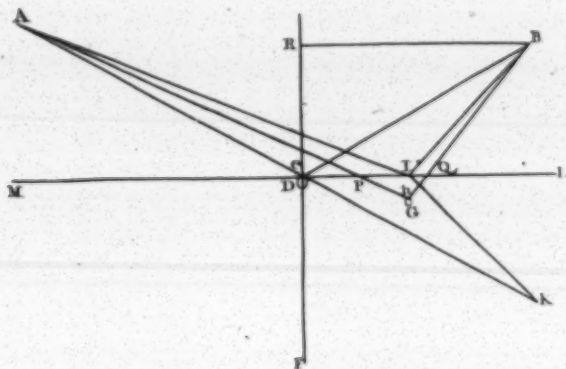
THUS far in the general of the Action of Muscles passing over one Joint. Before I proceed, I think it not amiss, upon the making mention of these Muscles of the Foot, to observe how admirably the Flexors of the Foot are contrived to

* Anthropograph. Lib. V. cap. 43.

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For when the Angle under AeB is so divided, the Line AeB will be the shortest; as is thus demonstrated.

LET eF be the Line, in whose Direction the Muscles of the *Os Hyoides* support the Ring D . Draw MeL perpendicular to eF , and produce Ae to K , till eK be equal to eB . Then because the Angles under AeF , FeB are equal, and MeL is perpendicular to eF , that is the Angles under MeF , FeL are equal, the Angles under MeA , LeB are likewise equal: But the Angle under LeK is equal to the Angle under MeA ; therefore the Angles under KeL , BeL are equal. Now let the Ring D change its Position to that of G : Then because the Line ML is perpendicular to the Line, in whose Direction the Ring in the Position D is supported, and the Muscles which support it, are supposed to have no additional degree of Tension given them by the changing of the Position of the Ring, the Ring must fall without the Line ML , and the Muscle inflected through it obtain the Situation AbB , cutting the Line ML in two points P , Q . Take at pleasure in the Line ML between P and Q the point I , and join AI , IB , and IK . Then in the two Triangles BeI , KeI the side eI is common to both, and the sides eB , eK , as likewise



the Angles under BeI , KeI equal: therefore the Bases IB , IK are equal. Whence the two Lines AI , IB are equal to the two Lines AI , IK , which exceed the Line AK ; because in every Triangle two of the sides are always greater than the third; but the point I is within the Angle under AbB , so that the Sum of the Lines AI , IB is less than the Sum of the Lines Ab , bB : Therefore the two Lines Ab , bB are greater than the Line AK , equal to the two Lines Ae , eB . Hence the Muscle AeB is shorter in the Position D of the Ring than in any other.

BUT now from hence will be easily determined all that is to be enquired into relating to this Muscle. The Ring D being at rest, when the Angle under AeB is divided into two equal Parts by the Line eF , the Action of the Muscle AeB will be the same, whether it be connected to the Ring D in the point e , or disengaged from it, as has hitherto been supposed. For the Angles under AeF , FeB being equal, the Tensions of the two parts Ae , eB of the Muscle would be equal, if it were connected to the Ring D in e , as well as when disengaged from it; and will

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will likewise be just as great in one case, as in the other. Therefore if from the point B the perpendicular BR be let fall upon the Line Fe , the force of the Part eB of the Muscle, or, which is the same thing, the force of the whole Muscle, will be to half the force, with which the Ring D is supported in the Direction Fe , as Be to eR . For this the Writers of Mechanics have demonstrated in the Case of the Muscle's being connected to the Ring D in e . So that the force of the Muscle AeB is to the whole force, with which the Ring D is supported, as Be to twice eR .

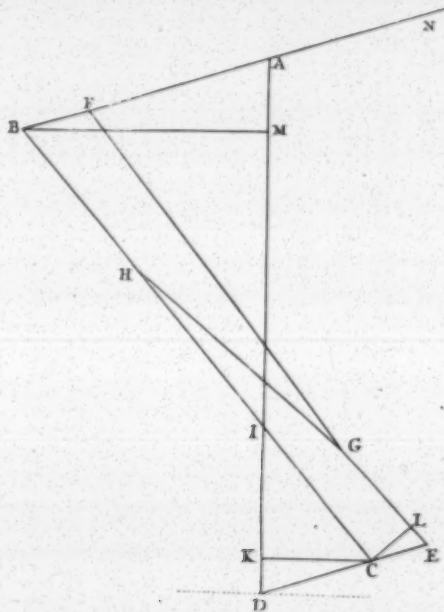
AGAIN, the two Parts of the Muscle Ae , eB , and the Ring D , are three Powers applied to the point e of the Muscle, acting in the respective Directions of eA , eB , and eF . But the Part eB is sustained by the point B , the moveable Extremity of the Jaw; upon which therefore it will act in the Direction opposite to that, in which it acts upon the point e . That is, the part of the *Digastric* Muscle between its Connection with the Jaw, and the annular Ligament of the *Os Hyoides*, through which it passes, lies in the Direction of its Action upon the Jaw.

THE Rule just laid down for assigning the Proportion of the force, with which the annular Ligament of the *Os Hyoides* is supported, to that of the *Digastric* Muscle, shews how a small degree of Force applied to this Ligament, may retain the Muscle in an inflected Situation: for the Angle under AeB may be taken of such a Magnitude, that twice eR shall be to eB in any ratio less than that of 2 to 1. And the Force, with which this Ligament is sustained against the Action of the *Digastric* Muscle, is in reality considerably less than the Force of the *Digastric* Muscle it self; the *Musculus Coracobyoideus* with a small Assistance from the *Stylohyoideus* being the principal, or rather the sole Supporter of that Ligament.

NOW it follows to treat of those Muscles, which lie over two or more Joints. The Influence these Muscles have upon one of the Joints, over which they pass, is easily determined; for they will contribute to the Motion of any one of the Joints, if the rest be fixed and held inflexible by other Muscles, in the same manner, as if they lay over none but that: and the Method of judging of their Direction, and estimating their Force is entirely the same: for the fixing the rest of the Joints determines the Action of the Muscle to that Joint, which is left moveable, as much as if those fixed Joints were one continued Bone. But the effect of such a Muscle upon those other Muscles, which secure the rest of the Joints, is something less obvious, and must distinctly be considered. For which purpose two Cases are separately to be examined; both attempted by *Borelli*, but neither sufficiently explained by him. One is, when a Muscle lies over two Joints, which bend the contrary way; the other when the Joints, over which the Muscle lies, bend the same way.

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THE Joints of the Knee and Foot, covered by the *Gasterocnemius externus*, are an instance of the first Case. For explaining this Case therefore, let *AB* represent the Thigh Bone, *B* the Knee, *BC* the *Tibia*, *C* the Joint of the Foot, *ED* the Foot it self, *GF* the *Musculus Gasterocnemius externus* connected to the Thigh Bone



in *F*, *GH* the *Gasterocnemius internus*, called by some the *Soleus*, connected to the *Tibia* in *H*, their common Tendon *GE* affixed to the *Os Calcis* in *E*. Let the Extremity of the Foot rest upon the Ground in *D*; and a Power be applied to the point *A* of the Thigh Bone *AB*, in the Direction of *AD*; let the Joint of the Knee *ABC* be held firm by its proper Muscles: then if a Stick or other rigid Body were laid in the Line *AD*, that one of its Extremities should touch, and rest upon the *Tibia BC* in *I*, and the other Extremity touch the Thigh Bone in *A*, sustaining the Power applied in that point *A*, the point *I* of the *Tibia BC* would be acted upon with the same Force, and in the same Direction as now, when the Power in *A* is sustained by the Angle under *ABI*: for by the fixing and rendering unalterable the Angle under *ABI* the Magnitude and Position of the Line *AI*, in whose Direction the Power in *A* acts, is as much secured, as by a rigid Body directly interposed between *A* and *I*: the point *I* therefore is pressed with the same Force, and in the same Direction in both Cases. But by the Intervention of a rigid Body between *A* and *I*, the Power in *A* presses the point *I* with the same Force, and in the same Direction of the Line *AID*, as if the Power in *A* were applied to the point *I* in the Direction of *ID*. Therefore by fixing, and securing the Angle under *ABI* from alteration, the point *I* is pressed with the same Force, and in the same Direction by the Power in *A*, as if that Power were applied to the point *I* in the Direction of *ID*. Now the *Musculi Gasterocnemii*, *externus* and *internus*, act in supporting the Angle under *BCD* in the Direction of their common Tendon *EG*; and the Force, with which they must act to sustain the Joint *C*, is to the Power applied in *A*, or *I*, by the Rule before laid down for Muscles lying over one Joint, as *CK* the perpendicular let fall from *C* to the Line *ID*, in whose Direction the Power acting

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acting against the Muscles is applied, to CL the perpendicular let fall from the same point C upon EG , the part of the Muscles supporting the Joint C , which lies in the Direction of their Action.

BUT this Force thus found must be divided between the *Gasterocnemius internus* and *externus*. That part of it, which appertains to the *Gasterocnemius internus*, has no Influence upon the Joint B , because the *Gasterocnemius internus* is connected to the *Tibia*. But the *Gasterocnemius externus* being connected to the Thigh Bone in F , its Action, which is no other than drawing the points E, F towards each other, tends as well to diminish the Angle under FBC , as to augment the Angle under BCD . Whence though the Power applied in A were actually applied in I , yet there would be required some degree of Force to sustain the Angle under FBC against the Action of the *Gasterocnemius externus*. But the Power, against which these Muscles act, not being applied in I , but in A , the Muscles, whose Office it is to support the Joint B , which are the Extenders of the *Tibia*, are required to exert a certain degree of Force to sustain the Angle under ABC , and preserve it from Diminution by the Pressure of the Power in A . And to the Force, which they exert upon this account, must be superadded that Force, which is required in them, to sustain the Heads of the *Gasterocnemius externus*.

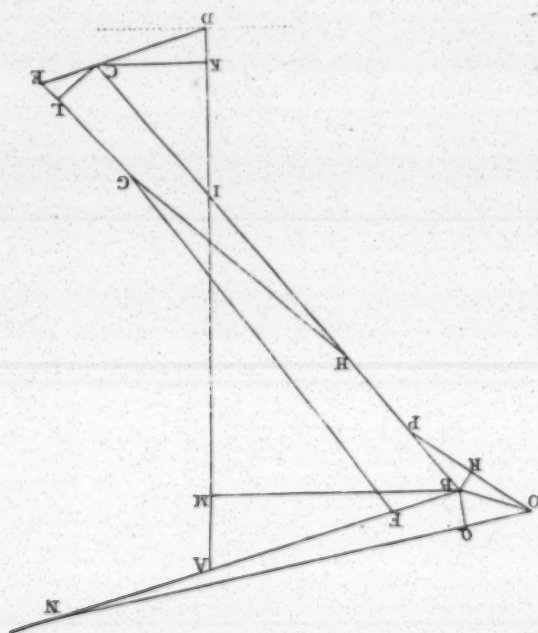
AND this is what is to be shewn in this first Case, that when a Muscle, designed for the Motion of any Joint, passes over another Joint, and is inserted into the second Bone from the Joint whose Motion it is designed for; when the Joints bend contrary ways, it is a strain upon the Muscles of that other Joint, over which it passes, and requires a greater degree of Force in those Muscles, when a Power is supported by the united Action of the Muscles of both Joints, than otherwise would be needful.

FURTHER, the Force exerted by a Muscle, passing over two such Joints, in sustaining the Joint, to which it properly belongs, being given, the degree of Force required in the Muscles of the other Joint to support its Action is easily determined. For instance, the Force required in the Extenders of the *Tibia* to support the *Musculus Gasterocnemius externus* is to the Force, with which the *Gasterocnemius externus* contracts, as the perpendicular let fall from B upon the Line FG , in whose Direction the *Gasterocnemius externus* acts, to the perpendicular let fall from B upon that part of the Extenders of the *Tibia*, which lies in the Direction of their Action, that is the part of their Tendons which lies over the Joint. Otherwise, if from the Weight in A be deducted that part of it, which is sustained by the *Gasterocnemius internus*, the Ratio of the remaining Part to the Force required in the Muscles of the *Tibia* to sustain the Action of the *Gasterocnemius externus*, will be compounded of the Ratio of CL to CK , and of the Ratio of the Perpendicular
let

1st fall from *B* upon the Line *FG* to the Perpendicular let fall from the same Point *B* upon the Extenders of the *Tibia*.

BESIDES, as this last named Perpendicular to BM , the perpendicular let fall from B upon the Line AI , in whose Direction the Power in A is applied, so is this Power applied in A to the Force required in the Extenders of the *Tibia* to sustain the Angle under ABC against the action of this Power. And these two Proportions give the whole Force required in the Extenders of the *Tibia* for the Support of the Limb $ABCD$ against the Power in A .

THIS Method of computing the Force required in the Muscles, which sustain the Angle ABC is agreeable to the Rule laid down above. *Borelli* * attempts the same after a manner something different. He compares these Muscles to a String connected by one end to the Thigh Bone, and by the other to the *Tibia*; and



inflected over the Extremity of a Line drawn from the Joint: like as the Line *NOP* is connected to *AB* in *N*, to *BC* in *P*, and inflected over the Extremity *O* of the Line *BO*, drawn from the Point *B*. He does not expressly say whether he takes the Line *BO* to make a given Angle with one of the Lines *AB*, *BC*, or to be moveable at liberty about the point *B*. If he designed the latter Case, he treats of it very defectively, and is farther blameable for proposing a Case, which does not correspond to the Joints; if he designed the first Case, the Rule he gives is erroneous. His Rule is, that *BQ* being let fall from *B* perpendicular upon the Part *NO* of the String *NOP*, and *BR* drawn perpendicular to the Part *PO*, the Tension of the String *NOP* is to the Power applied in *A* as *MB* the perpendicular let fall from *B* upon the Line *AD*, in whose Direction the Power in *A* is applied, to the fourth Part of the Sum of *BQ* and *BR* †. He says the

* De mot. Animal. Part. I. Prop. XLIX, & LIII. pag. 91, & 97.

† De motu Animal. Part. I. Prop. xxxviii. pag. 69. & Prop. xlix. pag. 91.

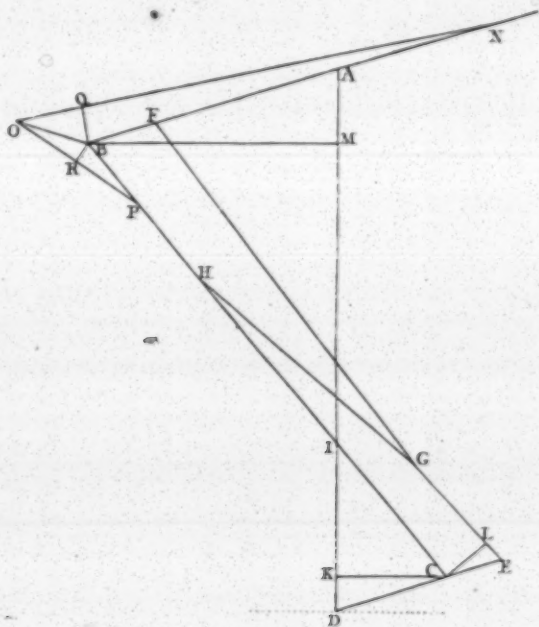
fourth Part, upon the account of his ascribing to Strings a Tension double to the Power, by which they are directly distended; which Opinion, or manner of Expression, I have before objected against*: Otherwise he would have taken half the Sum of the Perpendiculars BQ , BR . Now in case BO be moveable upon the Center B , and its Angle neither with the Line AB nor BC determined, this Rule is free from Error, but defective, because it does not observe the Perpendiculars BQ , BR to be equal, which they must be in order to the Sustainment of the Angle under ABC : for every part of the String NOP is equally distended, and the Tension of the Parts NO , OP being equal, they press upon the Point O , against which the String is distended in the Direction of the Line, which divides the Angle under NOP into two equal Parts; and that this Pressure may be in the Direction of the Line BO , which is required in order to the Stability of the Line BO , and that it be held fixed by this Pressure, the Line BO must divide the Angle under NOP into two equal Parts; that is, the Angles under NOB , POB must be equal. But in the Triangles BOQ , BOR , the Angles under BOQ , BOR being equal, as likewise the Angles under BQO , BRO , because both are right, and the Side BO being common to both Triangles, the Bases BQ , BR are equal; but the Distension of the String is to the Power applied in A , as MB to either BQ , or BR , and therefore to half the Sum of them. Consequently the Rule laid down by *Borelli* in this Case is not erroneous: Though, as I observed before, the Case it self is not applicable to the Joints, in which we find nothing supporting the Tendons, in such manner as to preserve constantly the same Distance from the Center or Axis of the Motion, at least on the convex Side of the Joint. And even on the concave Side, the Ligaments, by which the Tendons are often tied in the Flexures of the Joints, are not usually connected with the Bones near enough to the Axis of the Motion to perform such an Office.

In the other Case, when the Line BO is supposed to retain always the same Angle, either with the Line AB , or BC , suppose with BC , then the Perpendiculars BQ , BR may be unequal; in which Circumstance *Borelli's* Rule will be erroneous: for the Perpendicular BR let fall upon the Part PO of the String NOP , which subtends the given Angle, has no relation to the Tension of the String, that being performed in the Direction of NO , and therefore will be to the Power in A as MB the Perpendicular let fall from B upon the Line AD , in whose Direction the Power in A is applied, to BQ the Perpendicular let fall from the same Point B upon the Line NO , in whose Direction the String NOP is distended.

I DIFFER from *Borelli* likewise in computing the Force, with which the Muscles GF , GH , which support the Angle under BCD , are distended. I have declared it to be the same, as if a Power were applied to the Point I in the Direction of the Line ID , equal to the Power applied in A . *Borelli* affirms it to be the same, as if a Power were applied in the same manner, which should be to the Power applied in A as MB to CK . This he collects from the following Proposition, which

* Pag. 8, 9.

he attempts to demonstrate, That a trilineal arched Figure as $MBCK$, composing two alternate Angles under MBC , BCK , and having two of its Sides MB , CK parallel, being given, if its extreme Points M and K are impelled by two contrary Forces acting in the Direction of the same Line, viz. the Line MK , these Powers will be reciprocally proportional to the extreme Lines of the Arch, to which they are applied; that is to say, the Power applied in M will be to that applied in K as CK to BM *. Thus *Borelli* expresses himself. But this is a very indefinite manner of speaking, and carries no determinate Meaning with it. Certainly Powers may be applied to the Points M and K in the Proportion assigned;



and in any other Proportion likewise. He ought to have expressed what Consequence he expected from the Application of Powers in this Proportion. What is shewn, though very obscurely, in that which he subjoins as a Demonstration to the Proposition, seems to me to be this: That if the Point I , in which the middle Line BC intersects the Line MK , in whose Direction the Powers act, be fixed by a third Power, and the Angles under MBI , and KCI be equally strained by the Powers applied in M and K , then those Powers will be in the assigned Proportion. And the Proposition, which immediately succeeds this we are speaking of, and depends entirely upon it, is expressed in the same confused Manner, but shews only this, That if instead of the trilineal arched Figure $MBCK$, in which the extreme Sides MB , CK are parallel, be taken the trilineal Arch $ABCD$ in which the extreme Sides AB , CD may not be parallel, and in A and D be applied two such contrary Powers, acting in the Direction of the same Line AD , as the Point I being fixed by a third Power, shall equally strain the Joints B and C ; then the Power applied in A will be to that in D in the afore said Proportion of CK to MB †. But this is a Case widely different from that under Consideration at present, to which *Borelli* compares it. For in that neither is the Point I fixed

* De motu Animal. Part. I. Prop. XLVI. pag. 86.

† De motu Animal. Part. I. Prop. XLVII. pag. 87.

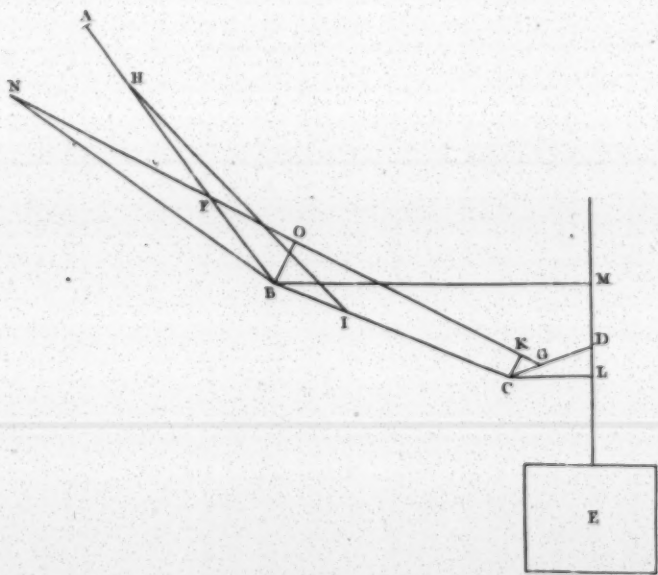
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by any third Power, nor the Angles under ABC , BCD necessarily strained in an equal Degree. In neither of the Propositions of *Borelli*, I have mentioned, is any thing said of a third Power applied in I , but must of necessity be supplied; for when the contrary Powers applied to the extremities of the Arch are not equal, the Machine cannot be supported without the Assistance of such a third Power.

BUT these Mistakes of *Borelli*, though proper to be animadverted upon in this Place, yet do not directly relate to the principal Design of the present Head of this Discourse, which is to shew, what Influence the Muscle FG has upon the Extenders of the Joint B . But in this neither has he proceeded with sufficient Caution: For having assigned to the Muscle FG a Tension double to the Power, by which it is distended, he assumes the Muscle to act upon the Point F with the whole Tension he ascribes to it *, contrary to his own Principles, and to the Reason he gives for the Tension of the Muscle's being double to the distending Power; that, as I have already remarked, being this, that the Muscle acts upon the Point F , and the Point F reacts against the Muscle, as much as the Power applied to the Muscle acts upon its other Extremity.

THUS far of the first Case of Muscles, which lie over a Plurality of Joints. It is now time to pass to the second, when the Joints, over which a Muscle lies, bend the same way. For the explaining this, let $ABCD$ be a compound Lever composed of three Arms AB , BC , CD . Let the Arm AB be fixed, the Weight E hung at the Extremity D , and supported by the Strings FG , HI ; the String FG passing over the two Joints B , C , and the String HI over the Joint B only,



the remotest from the Extremity D . Then it has been shewn †, that the Joint B being fixed by the String HI , the other String FG is distended by the Weight E

* De mot. Animal. Part. I. Prop. LII. pag. 95.

† Pag. 13.

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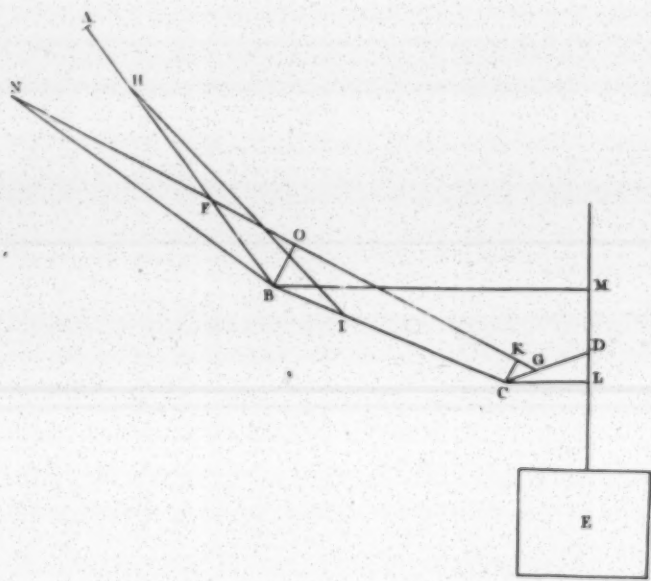
in the same Degree, as if that String were connected to the Arm BC , instead of AB ; that is, CK being let fall from C perpendicular upon FG , and CL perpendicular to DE , the Line, in whose Direction the Weight E acts, the Tension of the String will be to the Weight E as CL to CK . It is required to find the Tension of the String HI . This *Borelli* affirms to be as great, as if there were no Joint in C to be sustained by the String FG , but that BCD were one continued Arm of the Lever, and the String FG were removed *. What the Tension of the String HI really is, may be found thus. From the Point B let fall upon the Line DE , produced if needful, the perpendicular BM ; and the Connection of the String FG being continued, let the String FG be produced beyond F in a right Line, till the Distance of its Extremity N from the Point B be equal to the Perpendicular BM . To the Lever let another Arm be added BN , turning upon the Center B , and connected to the String GF produced in N . Then is the new Arm BN equal to the Perpendicular BM . Let fall from B upon the String FG the Perpendicular BO , and to the Extremity of the Arm BN , and perpendicularly to it, let a Power be applied, whose Ratio to the Weight E shall be compounded of the Ratio's of BO to BM or BN , and of CL to CK . Then the Power in N will distend the String NF , and being applied perpendicularly to the Arm BN , and BO being a Perpendicular let fall upon the String NF produced, the Power applied in N will be to the Tension of the String NF as BO to BN : but as CL to CK , so is the Tension of the String FG to the Weight E . Therefore the two Ratio's of BO to BN , and of CL to CK , compound the same Ratio with that, which is compounded of the Ratio of the Power applied in N to the Tension of the String NF , and of the Ratio of the Tension of the String FG to the Weight E . But the Ratio of the Power in N to the Weight E is compounded of the Ratio of BO to BN , and of that of CL to CK . The Ratio therefore of the Power in N to the Weight E , is compounded of the Ratio of the Power applied in N to the Tension of the String NF , and of the Ratio of the Tension of the String FG to the Weight E . Again, the Ratio of the Power in N to the Weight E is compounded of the Ratio of the Power in N to the Tension of the String NF , and of the Ratio of the Tension of the String NF to the Weight E . The two Ratios therefore, that of the Power in N to the Tension of the String NF , and that of the same Tension of the String NF to the Weight E , compound the same Ratio with that, which is compounded of the Ratio of the Power applied in N to the Tension of the String NF , and of the Ratio of the Tension of the String FG to the Weight E . Take away the common Ratio of the Power applied in N to the Tension of the String NF , and as the Tension of the String NF to the Weight E , so will the Tension of the String FG be to the same Weight E . The Tension therefore of the String NF caused by the Power applied in N is equal to the Tension of the String FG caused by the Weight E . Wherefore the Point F of the String NG is drawn by the Power applied in N in the Direction FN , and by the Weight E in the opposite

* De mot. Animal. Prop. XLIV. pag. 79.

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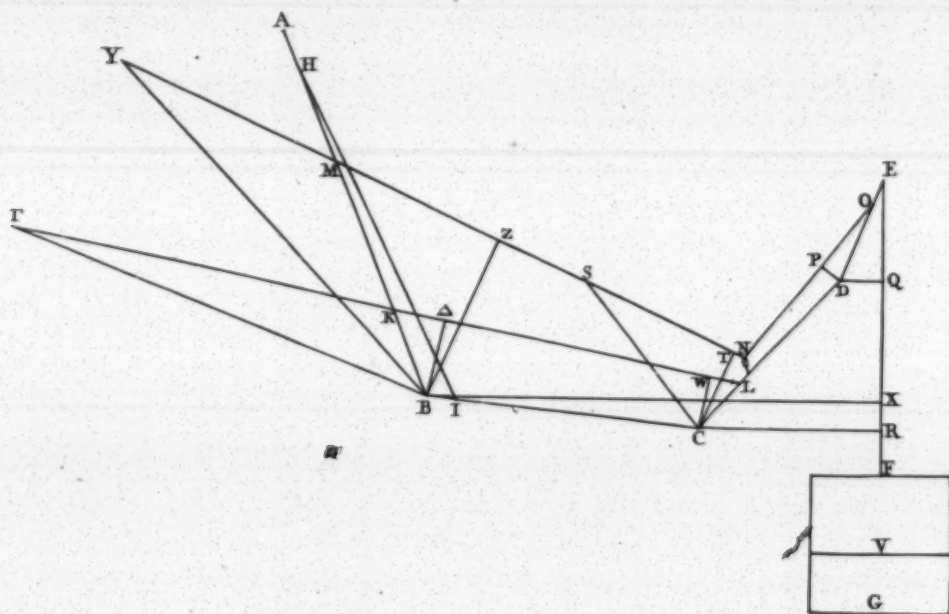
Direction FG with the same Force. So that if the Connection of the String NG with the Arm AB of the Lever in the Point F were loosed, yet the Point F of the String would be retained contiguous to the Arm AB by the Action of the Power applied in N . But since the Point F would remain in the same Place, whether connected to the Arm AB or not, it is evident that the String HI , by which the Arm BC is supported, will suffer the same Degree of Tension in both Cases. And when the String NG is connected to the Arm AB in F , the Power applied in N cannot at all affect the Tension of either String: For it can have no Influence upon the Part FG of the String NG , or upon any Part of the Lever, except the fixed Arm AB . From all which it follows, that the Tension of the String HI will remain the same, whether the String FG be connected to the Arm AB in F , and the added Arm of the Lever BN be removed with the Power applied to it in N , or the Connection of the String FG with the Arm AB be loosed, the String continued to N , and being connected to the Arm BN , the Power required be applied to N . But now the compound Lever $NBCD$ will per-



form the Office of a Balance upon the Center B , and if the Power applied in N be equal to the Weight E , as it will be, if BO be to BM as CK to CL , the String HI will undergo no Degree of Tension; but the Machine would remain in *Æquilibrio* without it: if the Weight E exceed the Power in N , the Tension of the String HI will be that required to sustain the Excess of the Weight E above the Power in N applied in the Point D , and Direction of DE . If the Power in N exceed the Weight E , the String HI ought to have a Degree of Rigidity sufficient to hinder the Diminution of the Angle under ABC , by supporting the Excess of the Power in N above the Weight E applied at the Distance of BN or BM : or else a String must be inflected on the outside of the Angle under ABC , which by its Tension shall support the same Resistance.

By this it appears, that in this Case, when a Muscle lies over another Joint besides that, whose Motion it principally presides over, and the two Joints bend the same way, the Muscle contributes to the Support of that other Joint, assisting the Muscles peculiar to that Joint; as in the other Case, when the Joints bend contrary ways, the Muscle common to both Joints was found to augment the Tension of the others.

AND this is sufficient to explain the Case of Muscles, which pass over two Joints; but when the Joints bend thus the same way, Muscles are often observed to lie over more Joints than two: the Consequence of which is to be collected much after the same manner. For this Purpose let $ABCDE$ be a Lever compounded of four Arms AB , BC , CD , DE set together in three Joints B , C , D . Let the Arm AB be fixed, and the Weight FG suspended at the Extremity E , the Arms BC , CD , DE supported by the three Strings HI , KL , MNO ; the first of which HI shall lie over the Joint B only, the second KL over two of the Joints B and C , and the third MNO over all three Joints B , C , and D , and besides be inflected through a Noose at N connected to the Arm CD . It is required to find the Tension of each String.

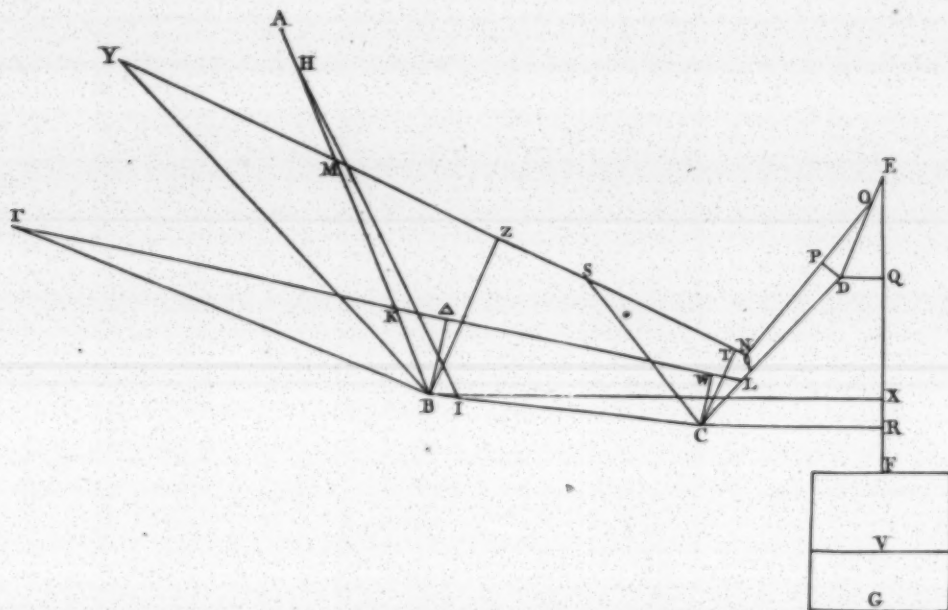


To begin with the String MNO , this being inflected, and passing freely through the Noose at N , both Parts of the String MN , and NO will receive the same Degree of Tension, but will not act, or rather resist the Power acting against them in the same Direction, but each in that Direction in which it lies: So that the Arms of the Lever BC , CD being supported by the proper Strings, the String MNO will support the Arm DE against the Weight FG in the Direction NO . Therefore from the Point D letting fall upon NO the Perpendicular DP , and the Perpendicular DQ upon the Line EF , in whose Direction the Weight FG acts,

acts, as DP to DQ so will the Weight FG be to the Tension of the String MNO . To find the Tension of the String KL let fall from the Point C the Perpendicular CR , and in the Joint C apply another Arm CS to the Lever, equal in length to the Perpendicular CR , and connected by its Extremity S to the String MN . Then if a Power be applied to S , as the String NO supports the Arm of the Lever DE in the Direction NO , so will the String SN support the Arm CS in the Direction SN . So that if the Power be applied in S perpendicularly to the Arm of the Lever CS , the Tension of the String SN by the Power applied in S will be to the Power applied in S as the Arm CS to the Perpendicular CT let fall from the Point C upon the String SN . Whence if the Power applied in S be taken to the Weight FG in the Ratio, which is compounded of the Ratio of CT to CR , and of that of DQ to DP , then the Tension of the String SN by the Power applied in S will equal the Tension of the String NO by the Weight FG . But the Part SN of the String SNO was before shewn to receive the same degree of Tension from the Weight FG as the Part NO , by reason of the free Communication of both Parts of the String through the Noose at N : So that the Part SN of this String will receive the same degree of Tension by the Weight FG , and by the Power applied in S . But the Directions of these two Tensions are contrary, that by the Weight FG being directed from S to N , and that by the Power applied in S from N to S ; being equal therefore and contrary, they sustain, and counterbalance each other. Hitherto the String SNO has been supposed to be connected to the Arm AB of the Lever in the Point M ; but the Part SNO being supported by these two contrary Powers in *Æquilibrio*, its Tension and Situation will remain the same, though the Connection of the String with the Arm AB be loosed. Hence it follows that the String SNO will contribute equally to the Sustension of the Arm CD , and the Tension of the String KL required for its entire Support will be the same; whether the String be sustained by the added Arm of the Lever CS , and the Power applied to it in S , or by the Connection of the String with the Arm AB in the Point M , the Arm CS and Power applied to it being removed; for the Arm CS has no Influence upon the Arms CD , or DE , but by the Intervention of the String SNO . But now the compound Lever $SCDE$ performs the Office of a Balance suspended upon the Center C , CS and CR being equal; wherefore the String KL sustains the Excess of the Weight FG suspended in E above the Power applied in S . Take from the Weight FG the Portion FV equal to the Power applied in S , and let fall from the Point C upon the String KL the Perpendicular CW ; then the Tension of the String KL will be to the Weight VG as CR to CW .

THUS is found the Tension of the String KL . To find the Tension of the String HI proceed thus. From the Center B let fall the Perpendicular BX upon the Line EF , and apply at the Center B a new Arm BT to the Lever, equal in length to the Perpendicular BX , and connected to the String NM produced beyond M by its Extremity T . Then a Power being applied in T perpendicularly to the Arm BT , this Power will be to the Tension of the String MT caused by it,

it, as the Perpendicular BZ , which is let fall from B upon TN , to the Arm BT ; and if the Power applied in T be to the Weight FG in the Ratio, which is compounded of the Ratio of BZ to BX , and of DQ to DP , the Tension of the String MT by the Power applied in T , and that of the String MNO by the Weight FG will be equal, and have a contrary Direction. So that this Power being applied in T , the String $TMNO$ will preserve the same Tension, and Position, whether connected to the Arm AB in M , or not. In like manner a new Arm BT being added to the Lever at the Joint B of equal length with the Perpendicular BX , and connected by its Extremity T to the String LK produced beyond K ; if a Power be applied in T perpendicularly to the Arm BT , whose Ratio to the Weight VG , that being the whole Weight, against which the String KL acts, shall be compounded of the Ratio of $B\Delta$, the Perpendicular let fall from B upon TL , to BX , and of CR to CW ; then the String TKL shall preserve the same Tension and Position, whether connected to the Arm AB in the Point K , or not. Therefore the Connections of the Strings $TMNO$, and TKL with the



Arm AB in M , and K ; BY , $B\Gamma$, and BX being all equal, the Tension of the String HI will be that required to sustain the Excess of the Weight FG above the Powers applied in Υ , and Γ . But if the Strings ΥMNO , ΓKL be connected in M and K , and the Powers applied to Υ and Γ be removed, the Tension of the String KI will be the same, because the Powers applied in Υ and Γ have no other Effect upon the Strings MNO , KL but the supplying the Place of the Connections in M and K ; nor any Influence upon the Arms BC , CD , DE , when the Strings are connected in M and K .

NOW from all which has been said may be drawn this general Observation; That in these compound Levers, when a String lies over other Joints, be-
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sides that it is principally designed to support the part of the Weight suspended at the Extremity of the Lever, which such a String supports at any other Joint, is to the whole Weight in the Ratio compounded of the Ratio of the Perpendicular let fall from that Joint upon the Part of the String, which is in the Direction of its Action upon that Joint, to the Perpendicular let fall from the same Joint upon the Line, in whose Direction the Weight supported acts; and of the Ratio of the Perpendicular let fall upon this Line from the Joint, to whose Support the String principally contributes, to the Perpendicular let fall from this Joint upon the String.

THIS is the general Rule for determining the effects of Muscles, which lie upon several Joints bending the same way; for such Joints do perfectly resemble the compound Levers, that have been now treated of. It next follows to apply the Rule to some particular Instances. And in the first place we may learn from hence the reason why the Flexor of the second Internode of the Fingers is not double in bigness to the Flexor of the third, as according to *Borelli's* Doctrine it ought to have been; for the Examination of these Muscles alone by the foregoing Rule shews us that the *Perforatus* needs not be much, if at all, greater than the *Perforans*; since we shall find that the Flexor of the third Internode supports near half the Action upon the second Joint of any Power applied to the Extremity of the Finger, and acting perpendicularly against it; especially if the Finger be in some measure bent, as most usually it is in its ordinary Action. By the preceding Rule the Flexor of the third Internode supports a part of the Action of such a Power against the second Joint, and that Part bears to the whole Action upon that Joint, the Ratio compounded of the Ratio of the Perpendicular let fall from the Center, whereupon the second Joint moves, upon the Tendon of the *Perforans* to the Perpendicular let fall from that Center upon the Line, in whose Direction the Power is applied to the end of the Finger, and of the Ratio of the distance of the Extremity of the Finger from the Center of the third Joint to the Perpendicular let fall from that Center upon the Tendon of the *Perforans*. But these two Ratios compound a Ratio not much differing from that of 1 to 2; so that the *Musculus Perforans* supports about half the Action of the Power upon the second Joint. But the Tension of the *Musculus Perforatus* is to the Power against which it acts, as the Perpendicular let fall from the Center of the second Joint upon the Line, in whose Direction the Power acts against the Extremity of the Finger, to the Perpendicular let fall from the same Center upon the Tendon of the Muscle; and there remaining no more than about half the Weight for this Muscle to act against, its Tension will be to the whole Weight as about half the first Perpendicular to the second. But this Ratio, in the Situation of the Finger and of the Line of Direction the Power acts in, which we have here supposed, is little different from that of the distance of the Center of the third Joint from the end of the Finger to the Perpendicular let fall from that Center upon the Tendon of the *Perforans*; which latter Ratio is the same with that of the Tension of the *Perforans* to the whole

Power supported. Hence it appears, that in these Muscles are required for the ordinary Actions of the Fingers no very different degrees of Tension; and consequently the Muscles themselves on this Account ought to be about the same Size. It is further worth notice in this Place, that the *Perforatus* acts with somewhat greater advantage upon the second Joint than the *Perforans* does; for the Tendon of the *Perforans* passing under that of the *Perforatus*, raises the latter to a greater distance from the Bone.

THUS far we see, that the Flexor of the second Internode of the Finger needs scarce exceed the Flexor of the third; but the first of these Muscles is found not only no greater than the other, but even considerably less; the reason whereof is to be drawn from another Consideration, namely from the Structure and Disposition of those Muscles, whose office it is to bend the first Joint of the Fingers. These Muscles are the *Lumbricales* and *Interossei*, which are partly inserted into the first Bone of the Fingers, and partly form Tendons, which passing on the inner side of the first Joint, are united with the Tendons of the Extender of the Fingers, and accompany them through their whole length. By which Formation these Muscles extend in some small degree the second Joint of the Fingers, and much more powerfully the third, and at the same time they are Flexors of the first Joint. As *Fallopius* made a very great Discovery in observing that these Muscles extend the second and third Joints of the Fingers *, so *Vesalius's* Sentiment that they likewise bend the first Joint † ought not to be neglected, since there are no other Muscles allotted to that Office, and yet without particular Flexors of this Joint the Motion of the Fingers would be imperfect; for if the preceding Rule be applied to the *Perforans* and *Perforatus* at the first Joint of the Finger, they will be found each to support about one third part of the influence upon this Joint of the Power applied to the Extremity of the Finger; and will leave one third part to be supported by Muscles proper to this Joint. But now these *Lumbricales* and *Interossei* by the forementioned Disposition of their Tendons, while they bend the first Joint, act against the Benders of the second and third, but chiefly against the Flexor of the third; insomuch that the Flexor of the third Joint ought to bear a greater Proportion to the Flexor of the second than would otherwise have been necessary. Moreover, the *Lumbricales* arise from the Flexor of the third Internode, whence this Muscle ought to be still larger, to enable it not only to execute its own office, but likewise to sustain the *Lumbricales* in the Performance of theirs.

WHAT has here been shewn of the Muscles of the Fingers contributing to the Support of all the Joints, over which their Tendons pass, leads us to one great

* Observ. Anatom. in Oper. fol. 243.

† De corp. human. fabric. Lib. 11. c. 43. & Observ. Fallop. examen. p. 71.

Design in this Contrivance of laying Muscles over several Joints, which is, that in those Joints, which bend the same way together, the same Muscle might be subservient to more Joints than one. Thus the *Perforans*, besides the third Joint of the Fingers, which it alone sustains, assists in supporting not only the two other Joints of the Fingers, as has been said, but likewise the Wrist: The *Perforatus* besides the second and first Joints of the Fingers assists in supporting the Wrist and Elbow Joint, it arising from the *Humerus*: and the *Lumbricales* have added to their Office of supporting the first Joint of the Fingers, another of assisting the Flexors of the Wrist.

THOUGH we find too, that a Muscle may pass over a Joint without sensibly contributing to the Motion of it, which I take to be nearly the Case of the *Palmaris longus*, and the two Flexors of the Wrist in respect of the Joint of the Elbow. The *Palmaris* arises from the very Apex of the internal Tubercle of the *Humerus*; so that its Origin is just in the Axis, upon which the Joint moves, and therefore can have no effect upon it. The two *Flexores Carpi* take their Rise from the same Tubercle of the *Humerus*, on each side the Head of the *Palmaris*, and contiguous to it: Wherefore they have their Origin so near to the Axis of the Joint, that their effect upon the Motion of it must be very inconsiderable. Besides, the small distance the Heads of these Muscles have from the Axis of the Joint in the *Flexor radialis* is toward the Inside, in the *Flexor ulnaris* toward the Outside: And what the Muscle which arises on the Inside of the Axis, contributes to the Flexure of the Joint, that which lies on the Outside will contribute to the Extension of it. So that when these Muscles act together, as they do when they bend the Wrist, or resist to the Extension of it, they destroy each other's Action upon the Joint of the Elbow, and in this Case have more certainly little or no effect upon it.

HENCE it should seem, that these Muscles are laid over the Joint of the Elbow only for the more convenient Situation of them. Which probably is one Design likewise in giving the *Gastrocnemius externus* its Rise from the lower Head of the Thigh Bone; for that, as has been shewn, by passing over the Joint of the Knee makes a greater degree of Force necessary in the Muscles of the Knee, which act with it, than would else be needful; so that this Muscle is so far from assisting to the Support of the Knee, that it has the contrary effect. Though another Intent may likewise be allowed of, which is, that the Muscle, when both the Joints over which it lies, are extended, should not be considerably shorten'd, and so preserve the Force of its Action more entire. And this seems more evidently to be intended in the Flexors of the *Tibia*. For by an Experiment of *Borelli*, which shall presently be more particularly spoke to, we find these Muscles by being contracted to lose considerably their Force *. But by giving them their Origin from the Os

* De mot. Animal. Part. I. cap. ix. pag. 51, 52.

Ischii, and so making them common to the two Joints of the Hip and Knee, their length is pretty nearly preserved the same in their ordinary Action, which is in walking, in which when the Knee is bent by these Muscles, the Thigh Bone is drawn forward.

THERE is another use likewise of extending Muscles over several Joints, which is the procuring to them a length capable of a sufficient degree of Contraction, without too great a Diminution of their Force. The Flexors of the second and third Inter-nodes of the Fingers, did they only pass from Joint to Joint, would be too short to be capable of giving the Fingers their necessary Motion. This Observation will shew us the Reason of the Contrivance of the Muscles of the Back. For as the Back could not be supported by one single Muscle, whose Fibres should pass quite from one end of the Spine to the other; so on the contrary, had these Muscles been composed of Fibres, passing only from *Vertebra* to *Vertebra*, each of them inserted into the *Vertebra* immediately succeeding that, from whence it arose, the Back could not have received any considerable degree of Motion, but must have been almost rigid. That one series of Fibres passing from one Extremity of the Spine to the other, could not support the Back, will thus appear. When the Spine is incurvated by a Burden laid upon the Shoulders, the Force which must be exerted by the Muscles of the Back to sustain any given Joint of the Spine is to the Weight of the Burden, and of the Part of the Body above the Joint as a Perpendicular let fall upon the Muscles from the Center, upon which the two *Vertebrae* forming the Joint turn, to the Perpendicular let fall from the same Center upon the right Line drawn perpendicular to the Horizon, through the common Center of Gravity of the Burden, and of the Part of the Body above the Joint. But if the Spine were supported throughout by one Muscle, the muscular Force applied to every Joint would be the same; and the Perpendiculars let fall from each Joint upon the Lines passing through the common Centers of Gravity of the Burden, and of the Parts of the Body superior to the respective Joints perpendicular to the Horizon would be required to bear to each other certain Proportions; which when deviated from, as could hardly be avoided in any Case, so that any of these Perpendiculars should become longer, than according to the required Proportion, the Joint belonging to it could not be supported by that Force, which supported the rest. To provide against this Inconvenience, the Muscles of the Spine are composed of short Fibres reaching over but a few Joints, by which means every part of the Spine has Fibres peculiar to it, to exert that degree of Contraction required to sustain the Part they belong to, independent of the rest. And on the other hand by extending these Fibres over more Joints than one, a length is given them sufficient to admit in the Back a convenient degree of Motion.

I SHALL now proceed to take into Consideration the Experiment of *Borelli* mentioned a little before, it is, that if the Thigh be held in that Position to the
Trunk

Trunk of the Body, it is in, when we stand erect; then if the *Tibia* be likewise extended, the Flexors of the *Tibia* will surmount near twice the Resistance applied to the Heel, as when the *Tibia* is bent to a right Angle with the Thigh *. Whereas on the contrary by another Experiment it is found, that when the *Humerus* and Cubit are extended parallel to the Horizon, the Flexors of the Cubit will not support so great a Weight applied in the Hand by a fifth Part, as when the *Humerus* is applied to the Side, the Body being erect, and the Cubit bent to a right Angle with it †.

THE Cause of this Difference is to be taken from the different Structure of the two Joints, and different Situation of the Muscles; which move them.

IN the first Place then the Joint of the Elbow, being designed to act in all degrees of Flexure indifferently, is an Articulation of a cylindrical Head in a very deep *Sinus*, whose Figure adequately fits it. On the other hand the Knee is principally employed with the *Tibia* extended, for which reason this Joint is so contrived and framed, that the Extenders of the *Tibia* shall act with as great a Force as possible in that Position of the *Tibia*. With this Design the lower Heads of the Thigh Bone articulated with the *Tibia* are formed of an oval Figure, such that their Section by a Plane perpendicular to the Axis of the Motion of the Knee will approach to the Figure of an *Ellipsis*, whose longer Axis produced will make an acute Angle with the Fore-part of the Thigh Bone: This Contrivance removing the Axis of the Motion towards the hinder Part of the Thigh Bone, and at a greater distance from the Tendons of the Extenders of the *Tibia*, than that Axis could have had, if these Heads had been cylindrical or spherical, unless the Joint had been made unsizeable and gouty. Though in order that this might completely answer the Design intended, a farther Contrivance was likewise necessary. In the Elbow the Head of the *Humerus* being cylindrical, it would admit of being lodged in a deep *Sinus*: but the Heads of the Thigh Bone being of an oval Figure could not act with sufficient Freedom in such a one; and therefore we find the *Sinus's* in the *Tibia*, which receive the Heads of the Thigh Bone to be shallow. But the *Sinus* of the *Ulna* being so large and deep, is formed laterally in the Bone with sufficient Security to the Joint; which the *Sinus's* of the *Tibia* by reason of their Shallowness could not. And by this lateral Disposition of the *Sinus* of the *Ulna*, the Tendons of the Muscles, which extend the Cubit, being connected to the Extremity of the *Ulna*, continue streight, without being inflected over the Joint, when the Arm is bent: But the Tendons of the Muscles extending the *Tibia* will undergo such an Inflection, and thence are exposed, when the Joint is much bent, to slide off from it, and become unfit for their Office, unless by some additional Contrivance secured. The most proper for which Purpose in Muscles of so great Strength, is the lodging their Tendons in a *Sinus* formed on the fore part

* De mot. Animal. loc. supra citat.

† Ibid. Prop. 22, 23. pag. 43, 44.

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of the Thigh Bone; and such a *Sinus* we find there. But because the depressing the Tendons in such a *Sinus* would in part frustrate the principal Design, namely that of removing the Tendons to the greatest distance from the Axis of the Motion; to avoid this the *Patella* is placed under the Tendons, and connected to them, fitting the *Sinus* in the Thigh Bone, and so securing the Tendons from sliding off the Joint; and yet preserving the distance of them from the Axis of Motion, nay increasing it.

BUT as this Structure of the Knee augments the Action of the Extenders of the *Tibia*, so it will have the contrary effect upon the Flexors; for the oval Figure of the Heads of the Thigh Bone removing the Axis, upon which the Joint turns, toward the hinder Part of the Bone, places it nearer to the Tendons of the Flexors than it would otherwise be.

THESE are the Effects, the Structure of the Knee has upon the Muscles, when the Joint is extended. As the Knee is bent, the oval Figure of the Heads of the Thigh Bone will force the Axis of Motion continually to recede backwards; which would cause it to approach the Tendons of the Flexors, and become nearer to them, when the Knee was bent, than when extended; but that those Tendons are inserted into the *Tibia* in such a manner, as obliges them, at the same time the Axis approaches toward them, to rise from the Joint; which they do so considerably, that their distance from the Axis of Motion, if not increased, does by no means seem to be diminished by the Joint's being inflected. From hence may be drawn this Remark, as the Result of what has been here said, that these Muscles do not appear less conveniently situated to act upon the *Tibia* when the Knee is bent, than when extended; but that the Diminution of their Force is entirely to be ascribed to the Alteration made in the Muscles themselves by being contracted, and that they lose their absolute Force in no less Proportion, than that in which the Weight applied to the Heel is diminished.

WHY the Flexors of the Cubit do not in the same manner lose part of their Action upon the Arm by the bending of the Elbow in the recited Experiment, but on the contrary have it augmented, comes next under Consideration. And in the first place it is to be observed, that the *Os Femoris* in the Experiment upon the Flexors of the *Tibia* has the same Situation in respect of the *Os Innominatum*, from whence those Flexors rise, in both Cases; but in the Experiment upon the Arm the *Humerus* does not preserve in both Cases the same Position with respect to the *Scapula*; being applied contiguous to the Side, when the Elbow is bent, and extended to a right Angle with the Trunk of the Body in the other Case. Upon this account the *Biceps*, one of the Flexors of the Arm, arising with both its Heads from the *Scapula*, will be no shorter with the Elbow bent, than with it extended; and therefore however its Force might diminish by its being shorten'd, in this Experiment, it will act with no less a degree of Force in one Case than in the other;

nay,

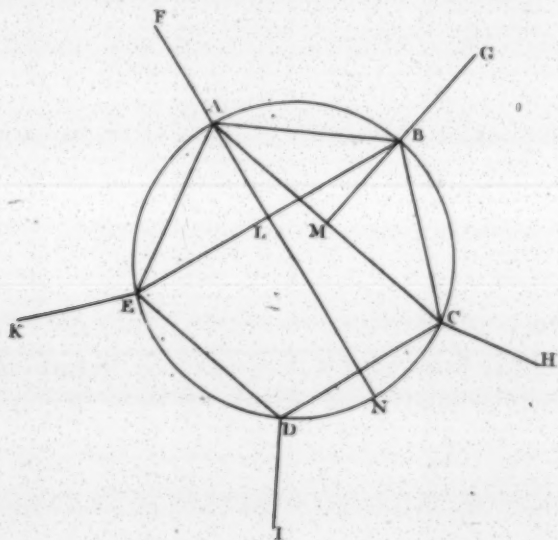
may, must act with greater Force, when the Elbow is bent, its Tendon rising then a little from the Joint. *Borelli* does not say whether the Experiment was made with the Arm extended forward, or laterally, nor is it of great Importance to know that Circumstance; for though the two Heads of the *Biceps* will not in both Cases be at the same distance from the other Extremity of the Muscle, yet are they so disposed, that whenever one Part of the Muscle is any thing relaxed, the other will be proportionally distended, one of these Heads passing on the Inside, the other on the Outside of the Shoulder Joint. Thus much of the *Biceps*. The *Brachialis internus* arising from the *Humerus*, will by bending the Elbow be too much shortened to preserve its Force entire, but must in all Probability be render'd so much weaker, as to make some farther Assistance necessary to move the Cubit with greater Force when bent, than when extended. For the Force of this Muscle bears so great a Proportion to that of the *Biceps*, that the losing any great part of the Action of this, if it does not lessen the united Action of both, and diminish the Force with which the Arm is bent, must at least so far abate their Force, as to render them incapable of supporting a Weight so much as a fourth Part greater in this Case than in the other, unless they be assisted by some other Muscle, which like the *Biceps* should have its Force increased by the bending of the Arm, and be likewise so large, that the Action of the *Brachialis internus* shall bear but a moderate Proportion to the whole Force with which the Arm is bent. Such a Muscle I take to be that usually called *Radius Supinator longus*, a large Muscle, and without doubt a Flexor of the Arm; for it is to be perceived externally by the Touch to act very strongly when the Arm is forcibly bent; and besides, by having its Origin at a great distance from the Joint, it rises when the Elbow is bent, very high from it; probably not a little more than is sufficient to compensate what Diminution it may suffer in its Action by being shorten'd.

THE Action of Muscles lying over a Plurality of Joints having been thus largely explained, the first general Head of this Discourse may now be brought to a Conclusion, by adding only a few Words concerning the Action of a sort of Muscles not employed in moving any solid Part: I mean the Sphincters; whose Action upon the Bodies included within them, I shall now explain.

LET *ABCDE* be a String in the Figure of a regular Polygon sustained by Powers applied to each of its Angles *A, B, C, D, E* in the Direction of the Lines *AF, BG, CH, DI, EK*, making equal Angles each of them with the Sides of the Polygon including the Angle to which the respective Power is applied. I say in the first place the Powers are all equal, as likewise the Tension of every Side of the Polygon. Draw *EB* and produce *FA* to *L*; then the Angles under *FAB, FAE* being equal, for that is supposed, and the Power applied in *A* supported by the Tension of the Sides *AB, AE* of the Polygon, the Tension of *AB* is to half the Power applied in *A* as *AB* to *AL*. In like manner drawing *AC*, and producing *GB*

to

to M , the Tension of AB is to half the Power applied in B as AB to BM . But because the Figure $ABCDE$ is a regular Polygon, the Lines AL and BM are equal; the Power therefore applied in B is equal to that applied in A . In the same manner the Power applied in C will be equal to that in B , and so of the rest. Wherefore the Powers applied in A, B, C, D, E are all equal one to another. But the Angles under $F AE, FAB, GBA, GBC, HCB, HCD, IDC, IDE, KED, KEA$ are all equal, whence the Powers applied in A, B, C, D, E being equal, it is evident, that every Side of the Polygon will suffer an equal degree of Tension.



I SAY again, the Sum of all the Powers is to the Tension of the String, as the length of the String to the Semidiameter of the Circle circumscribed about the Polygon.

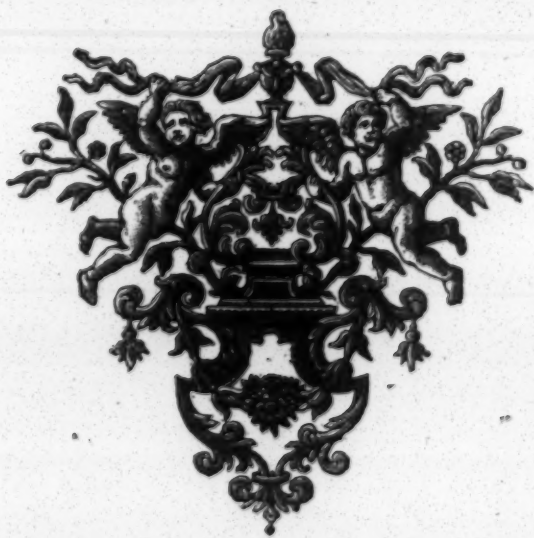
DESCRIBE about the Polygon a Circle, and produce AL till it meet the Circumference in N ; then is AN the Diameter of the Circle, because it divides the Angle under EAB of the Polygon into two equal Parts; and BL is perpendicular to AN , therefore as AB to AL so NA to AB . But as AB to AL so is the Tension of the Side AB of the Polygon to half the Power applied in A . Whence as AN to AB so is the Tension of the Part AB of the String to half the Power applied in A . But as AB to the whole length of the String $ABCDE$, so half the Power applied to half the Sum of all the Powers, they being equal to one another, and equal likewise in Number to the Sides of the Polygon. Wherefore by Equality as AN the Diameter of the Circle to the length of the String, so is the Tension of the Part AB of the String, or the Tension of the whole String, for every Part of it has been shewn to be equally tense, to half the Sum of the Powers applied in A, B, C, D, E . And lastly, as half the Diameter of the Circle to the length of the String, so is the Tension of the String to the Sum of all the Powers.

FARTHER,

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FARTHER, if in the room of the Powers, passive Resistances only be applied to the Points, *A, B, C, D, E*, and the String be endued with a Power of Contraction, the Force, the String contracts with, will be to the Force, impressed upon all the Resistances, as the Tension of the String in the other case to the Sum of all the Powers, that is, as the Semidiameter of the circumscribed Circle to the length of the String. But if the number of these Resistances, and of the Sides of the Polygon be continually encreased without limit, the Polygon will at last coalesce with the Circle circumscribed, and the Length of the String will be the Circumference of that Circle. In this case therefore the Force of the String's Contraction will be to the Force, with which it acts upon Resistances applied to every point of the Circumference of the Circle, or to its Pressure upon the whole Surface of a Body, which should adequately fill the Circle, as the Semidiameter of that Circle to its Circumference. And the Power, with which the String contracts, will be to the Force, with which any given Part of it acts upon the Body lodged in its Concavity, as the *Radius*, with which the Arch it is formed into is described, to the length of such Part. Thus therefore may be determined the action of the Sphincters upon the Bodies they encompass.



PART

PART II.

HAVING thus attempted to explain the effects of the Muscles upon the Parts they are appointed to move, I shall now proceed to the other Head of my design, and make some enquiry about the cause, that contracts the Muscles, by taking into consideration one or two of the most received opinions concerning that matter.

As it was observed at the beginning of this Discourse, that the Muscles consist of two Parts, the Tendons and the fleshy Fibres; whereof the fleshy Parts only are found to suffer a change in the action of the Muscle; therefore to discover the immediate cause of muscular Motion, it appears necessary to enquire particularly into the Structure of these fleshy Fibres.

ACCORDINGLY most of the late writers upon this Subject have supposed these Fibres to be formed into Vesicles or Cells, whose inflation and distension by some fluid within them they conclude to be the cause, that contracts those Fibres, and the Muscle.

Now whereas this opinion has not been confirmed by any direct proofs, but is an Hypothesis only, and well received on no account so much as the extreme difficulty of conceiving any other means that might so easily produce the effect under consideration; our first step shall be to examine what degree of probability may justly be allowed to this vesicular Structure of the muscular Fibres; and afterwards we shall likewise consider the most approved Conjectures, that have been made at the Cause, whereby the Juices contained in these Cells might be inflated. And since the vesicular Hypothesis requires the Fibres, when contracted, to encrease in Thickness by the Enlargement of their Cavities, it shall first be shewn, what increase in these Cavities of the Fibres will be consequent upon any proposed degree of the Fibres Contraction; in order to make a judgment whether the Intumescence, that may seem necessary to be ascribed to the Fibres and to the whole Muscle upon this Principle, agrees with what is observed in the motion of the Muscle.

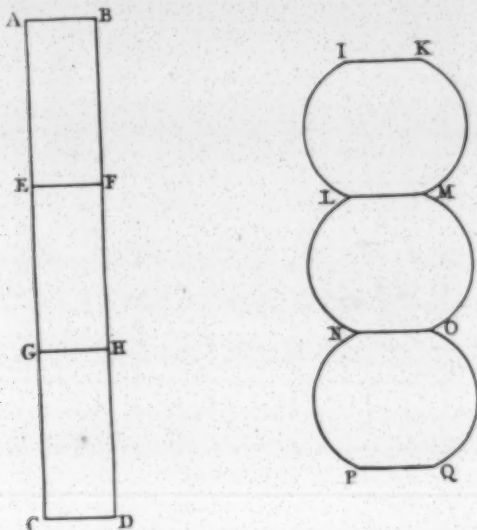
BUT in order to this it must be first observed, that according to the degree of Contraction it shall be found necessary to assign to the Muscles, these Cavities may be supposed differently formed. If it be desired to give the Fibres as great a contractile Power as this Hypothesis can admit of, we must suppose the Fibres to be composed of compleat Bladders connected together by a small part only of their superficies in the manner they are usually delineated*: And upon this supposition the Fibre may contract into less than to half its length, as shall hereafter be shewn. But if a less degree of contraction be sufficient to answer all the appearances of muscular Motion, then the Fibres may be supposed hollow Cylin-

* Vid. Fig. 2, 3, 4, 5. in Jo. Bernoulli Dissert. de Mot. Muscul.

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ders as $ABCD$, divided into cells as $ABFE$, $EFGH$, $GHDC$, either by transverse membranes of sufficient Strength, or by being invested at the proper Intervals by



annular Ligaments, that may hinder the parts they bind from yielding to the expanding Fluid, while the intermediate parts are protruded outwards, and the Fibre receive the Figure $IKLMNOPQ$.

IN the next place we must enquire into what kind of Figure the sides of these Vesicles will be expanded. The celebrated *John Bernoulli* attributes to them a circular Figure; but the calculations, upon which he grounds his assertion, are thus far deficient, that he considers these cells as plane Figures, and not as Solids made by the revolution of a plane Figure about an Axis, as they really are. Accordingly upon a strict Enquiry we shall find this circular Figure something distant from the truth. If the cells of the Fibres are distended by an included Fluid, it is evident that the Figure they must take, will be that, which will admit of the largest Cavity, that can be in any given distance between the Bases of the Cells; and the Coats of these Cells being supposed to yield without resistance to their dilatation in breadth, and only in length to remain undistensible, the Enlargement or Diminution will wholly depend upon the Figure of the Arch, into which their Sides are bent.

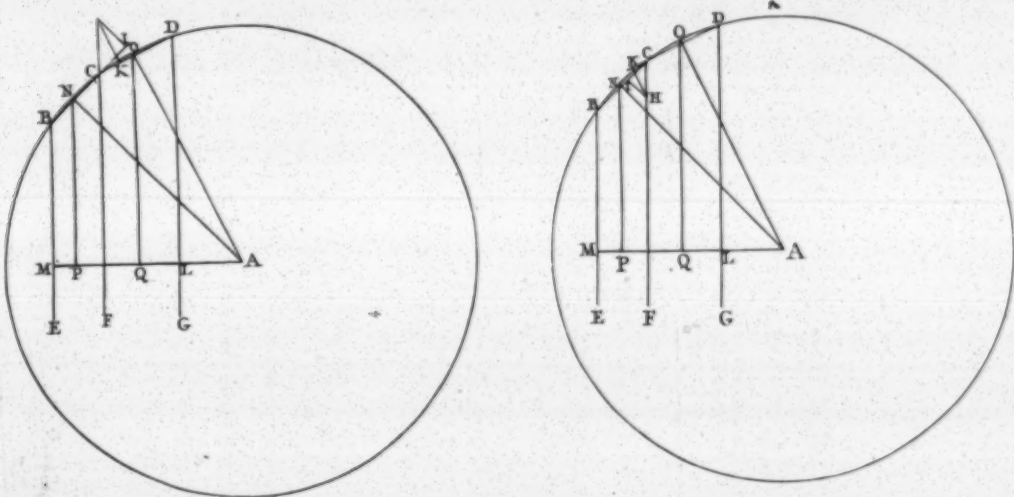
IN order therefore to determine this Figure we must have recourse to the Problem concerning isoperimetrical Curves long since celebrated among the Geometers; so much of which Problem, as relates to our present purpose, shall here likewise be considered in the following Propositions.

PROPOSITION I.

THREE Points in the circumference of a Circle being given, and from them three parallel right lines being drawn, as likewise two Chords from the middle point to the two others; then if any point be taken in the middle parallel, from whence perpendiculars shall be let fall upon the Chords, I say, the Distances between the parallels being diminished without limit, the ultimate *Ratio* of the Segment of the middle

middle parallel, intercepted between the point last assumed and the circumference of the Circle, to the difference between the Segments, cut off from the Chords by the perpendiculars let fall upon them, will be the same, as the *Ratio* of the semidiameter of the Circle to half the distance between the extreme parallels.

IN the Circumference of a Circle whose Center is *A* let the three points assumed be *B*, *C*, *D*, and the three parallel right lines *BE*, *CF*, *DG*, as likewise the Chords *BC*, *CD*; Let *H* be the point taken in *CF* the middle parallel, the perpendiculars



HI, *HK* being let fall from this point *H*, upon the Chords *BC*, *CD*, cutting off from those Chords the Segments *CI*, *CK*. If the Distances between the parallels *BE*, *CF*, *DG* are diminished without limit, I say the ultimate *Ratio* of *CH* to the difference between *CI*, *CK* is the same with that of the semidiameter of the Circle to half the Distance between the parallels *BE*, *DG*.

LET *ALM* be drawn perpendicular to *DG*, *CF* and *BE*. Let the semidiameters *AN*, *AO* be drawn perpendicular to the Chords *BC*, *CD*, and let *NP*, *OQ* be drawn perpendicular to *AM*. This preparation being made, because *AN* and *HI* are both perpendicular to the same line *BC*, they are parallel; and *NP*, *HC* are also parallel, being likewise perpendicular to the same line *AM*, therefore the Angles under *ANP*, *IHC* are equal. Whence the rectangular triangles *IHC*, *NAP* are similar, so that *HC* shall be to *CI* as the semidiameter *AN* to *AP*: In like manner the triangles *OQA*, *HKC* are similar, and *HC* to *CK* as the semidiameter *AO* to *AQ*. Therefore because *HC* was to *CI* as the semidiameter *AN* to *AP*, it follows that *HC* is to the difference between *CI* and *CK* as the semidiameter of the Circle to *PQ*. But now the points *B*, *C* and *D* approaching without limit the ultimate *Ratio* of *PQ* to *ML* the distance between the parallels *BE*, *DG* will be that of 1 to 2, whence the ultimate *Ratio* of *HC* to the difference between *CI*, *CK* will be that of the semidiameter of the Circle to half the distance between the extreme parallels *BE*, *DG*.

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PROPOSITION II.

TWO Curves, described to the same Abscisse with their respective Ordinates perpendicular to it, being so related to each other, that every Ordinate of one Curve bear constantly the same relation to that Ordinate of the other Curve, which lies in a direct Line with it, independent on any other variable Magnitude; I say if one of the Curves be of that Form, whereby the other Curve shall comprehend a greater Space than if the first Curve received any other Form, while it continued of the same length, then this first Curve shall be concave towards the Axis, when the Ordinates of the two Curves encrease together, otherwise it shall be convex to its Axis.

LET the two Curves * be AB, CD , their common Abscisse EF , the Perpendiculars to this Abscisse, AE, BF being Ordinates in the Curve AB , and EC, FD Ordinates in the Curve CD ; the adjoining Ordinates of the Curves AB, CD bearing constantly the same relation to each other independent on any other variable Magnitude; then let the Curve AB be of that Form, that the space $ECDF$ shall be greater than could be comprehended by a Curve generated from any other Curve passing through the Points A, B , and of the same length with the Curve AB , in the same manner as the Curve CD is generated from this Curve AB : This being supposed, I say, when the Ordinates of the two Curves bear such a relation to each other, that the greater Ordinates in one of the Curves correspond to the greater Ordinates of the other, then the Curve AB is concave to the Axis EF , otherwise it is convex to it.

IF possible let the Curve AB be convex to the Axis, when the Ordinates of the two Curves are so related to each other as to increase and decrease together. Take in the Curve AB two Points G, H , and to the Abscisse EF ordinately apply GIK, HLM . Divide IL into three equal parts in the Points N, O , ordinately applying PNQ, ROS . Join the Chords GP, PR, RH , and draw three other Lines GT, TV, VH , whose sum shall be equal to the sum of the three Chords GP, PR, RH ; so that NT be greater than NP and OV less than OR . Through the Points G, T, V, H , let some Curve Line be described equal in length to the Curve passing through the points G, P, R, H , and let the Curve $KWXM$ be generated from the Curve passing through G, T, V, H in the same manner as the Curve $KQSM$ is generated from the Curve $GPRH$. Now the Curve CD being so formed from the Curve AB , that the greater Ordinate in the Curve CD corresponds to the greater Ordinate in the Curve AB ; NP being less than NT , NQ shall be less than NW ; and OV being less than OR , OX shall be less than OS . Again, because the space $ECKQSMDF$ generated from the Curve $AGPRHB$ is greater than the space

* Vid. Fig. Pag. xxxix.

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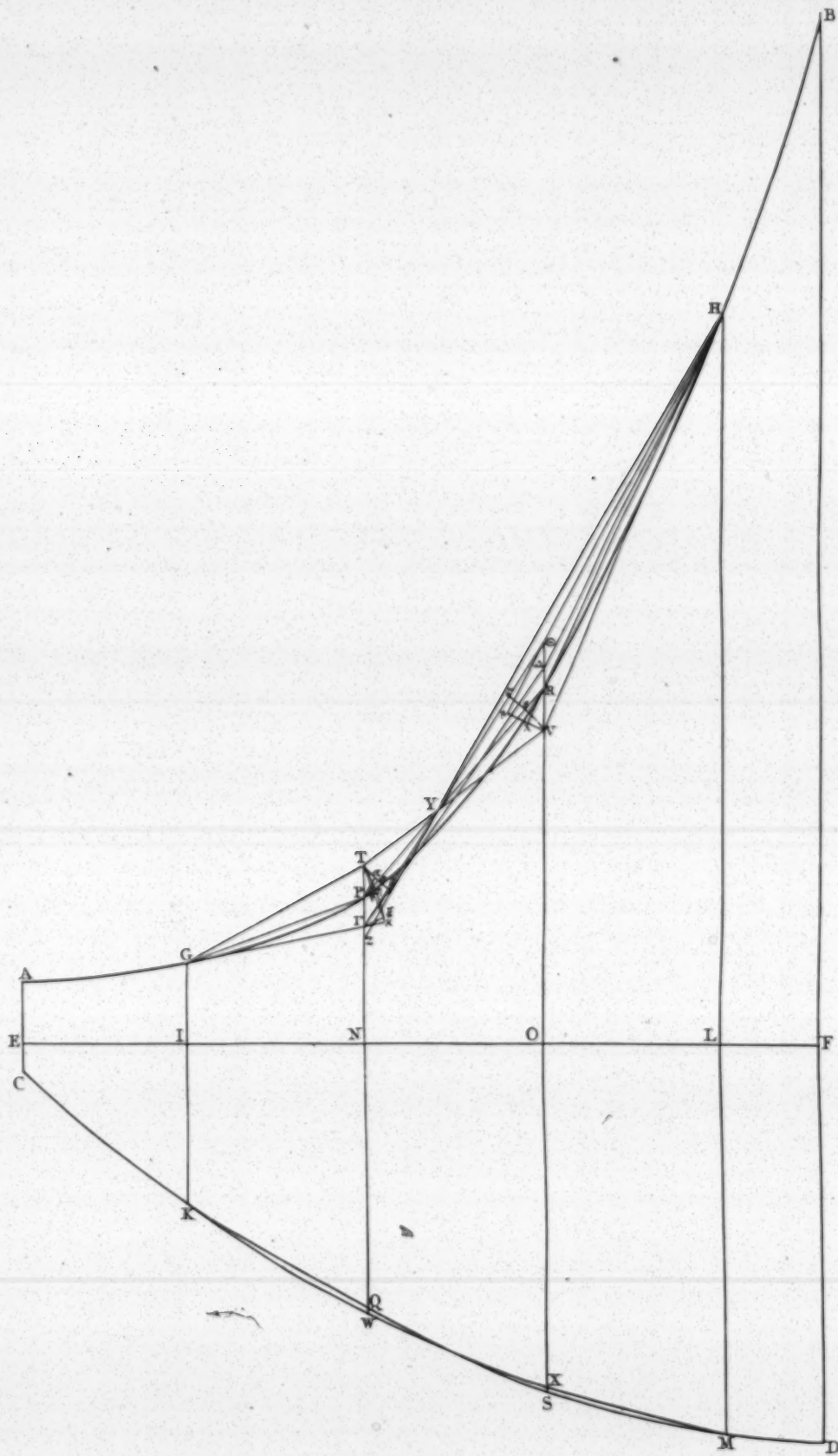
generated in like manner from any other Curve drawn through the points A, B , of the same length with the Curve $AGPRHB$, the space $ECKQSMDF$ is greater than the space $ECKWX MDF$, and the space $IKQ SML$ greater than the space $IKWXML$. In the next place, let the Points I, L approach without limit, and the space $IKQ SML$ will coalesce with the space included by the Lines KI, IL, LM , and the parabolical Line described by Sir *Isaac Newton's* Method of Differences through the Points K, Q, S, M ; in like manner the space $IKWXML$ will also coincide with the space included by the Lines KI, IL, LM , and such a parabolical Line described through the Points K, W, X, M . Therefore the space contained by the parabolical Line passing through the Points K, Q, S, M is greater than that comprehended by the parabolical Line passing through the Points K, W, X, M . But the first of these parabolical spaces is one eighth part of the Rectangle under IL , and under the sum of IK, LM together with three times the sum of NQ, OS ; likewise the latter parabolical space is one eighth part of the Rectangle under IL , and under the sum of IK, LM together with three times the sum of NW, OX . Therefore the sum of IK, LM together with three times the sum of NQ, OS is greater than the sum of IK, LM together with three times the sum of NW, OX ; and the sum of NQ, OS is greater than the sum of NW, OX ; and in the last place, deducting OX and NQ, SX will be greater than QW . Again, NQ, NW, OS, OX bearing the same relation to NP, NT, OR, OV respectively, the Points N, O approaching without limit, when the ultimate Ratio of QW to SX is a Ratio of lesser inequality, the ultimate Ratio of PT to VR shall likewise be a Ratio of lesser inequality; that is, PT shall be less than RV . Farther, let PR, TV intersect each other in T , and let HTZ be drawn; then between P and Z taking any Point Γ , let the three Lines $G\Gamma, \Gamma\Delta, \Delta H$ be drawn, whose sum shall be equal to the sum of the three Chords GP, PR, RH . Which being done, as it has now been proved, that when NT is greater than NP , and OV less than OR , PT is less than VR ; so after the same manner it will appear, that $N\Gamma$ being less than NP , and $O\Delta$ greater than OR , $P\Gamma$ is greater than $R\Delta$. Moreover, let $\Gamma\Theta$ and ΘH be drawn; then PT being less than RV , $P\Gamma$ which is greater than $R\Delta$, shall be less than $R\Theta$, and therefore $R\Theta$ greater than $R\Delta$; and in the last place the sum of the Lines $\Gamma\Delta, \Delta H$ greater than the sum of the Lines $\Gamma\Theta, \Theta H$, because the point Θ falls within the Triangle made by the Lines $\Gamma\Delta, \Delta H$ and the right Line that would join the points Γ, H .

Now with the Center T describe the circular Arches $T\alpha\beta, V\epsilon\zeta$; with the Center G describe the Arch $T\eta\kappa$, GP being produced to η , and $G\Gamma$ to κ ; lastly, with the Center H describe the Arch $V\lambda\mu$, HR being produced to λ , and $H\Theta$ to μ . Draw $\Gamma\xi$ parallel to GP , and the Chord $T\nu\zeta$; then is $\Gamma\xi$ greater than $\Gamma\kappa$ and $P\nu$ less than $P\eta$; so that the Ratio of ΓT to TP , which is the same with the Ratio of $\Gamma\xi$ to $P\nu$, is greater than the Ratio of $\Gamma\kappa$ to $P\eta$. Likewise, drawing $P\pi$ parallel to ΓT , since $P\pi$ is greater than $P\alpha$, the Ratio of $\Gamma\beta$ to $P\alpha$ exceeds the Ratio of $\Gamma\beta$ to $P\pi$, and therefore yet more exceeds the Ratio ΓT to TP ; in like manner

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ner the *Ratio* of ΘV to VR is greater than the *Ratio* $\Theta \mu$ to $R\lambda$, and the *Ratio* of $\Theta \zeta$ to $R\varepsilon$ greater than the *Ratio* of ΘV to VR . Therefore because ΓT is to TP as ΘV to VR , the *Ratio* of ΓT to TP is greater than the *Ratio* of the sum of $\Gamma \kappa$,



$\Theta \mu$ to the sum of $P\eta$, $R\lambda$, and the *Ratio* of the sum of $\Gamma \beta$, $P\alpha$ to the sum of $\Theta \zeta$, $R\varepsilon$ greater than the *Ratio* of ΓT to TP . Whence the *Ratio* of the sum of $\Gamma \beta$, $\Theta \zeta$ to the sum of $P\alpha$, $R\varepsilon$ is greater than the *Ratio* of the sum of $\Gamma \kappa$, $\Theta \mu$ to

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to the sum of $P\eta$, $R\lambda$. But the sum of GP , PR , RH being equal to the sum of GT , TV , VH , and also GT equal to $G\eta$, TV equal to $\alpha\epsilon$, and VH equal to $H\lambda$, deducting from the preceeding sums the sum of GP , TV and RH , there will remain the sum of $P\alpha$, $R\epsilon$ equal to the sum of $P\eta$, $R\lambda$. Since therefore the *Ratio* of the sum of $\Gamma\beta$, $\Theta\zeta$ to the sum of $P\alpha$, $R\epsilon$ is greater than the *Ratio* of the sum of $\Gamma\kappa$, $\Theta\mu$ to the sum of $P\eta$, $R\lambda$, the sum of $\Gamma\beta$, $\Theta\zeta$ is greater than the sum of $\Gamma\kappa$, $\Theta\mu$. Hence $\beta\zeta$ being equal to TV , $G\kappa$ equal to GT , and $H\mu$ equal to HV , if to both the preceeding sums be added the sum of $G\Gamma$, TV , ΘH , the sum of $G\Gamma$, $\Gamma\Theta$ and ΘH will be found greater than the sum of GT , TV and VH ; which latter sum is equal to the sum of GP , PR and RH , equal to the sum of $G\Gamma$, $\Gamma\Delta$, and ΔH : Therefore taking away $G\Gamma$ from the first and last of these sums, there remains the sum of $\Gamma\Theta$, ΘH greater than the sum of $\Gamma\Delta$, ΔH ; but it has been likewise shewn that the sum of $\Gamma\Delta$, ΔH is greater than the sum of $\Gamma\Theta$, ΘH , which is an absurdity: Therefore the Curve AB is not convex to its Axis, when the Ordinates of the two Curves AB , CD increase and decrease together. And after the same manner is shewn that the Curve cannot be concave to its Axis, when the Ordinates in one of these Curves increase, while the Ordinates in the other decrease. It remains therefore that the Curve AB be concave to its Axis in the first case, and convex to it in the latter.

PROPOSITION III.

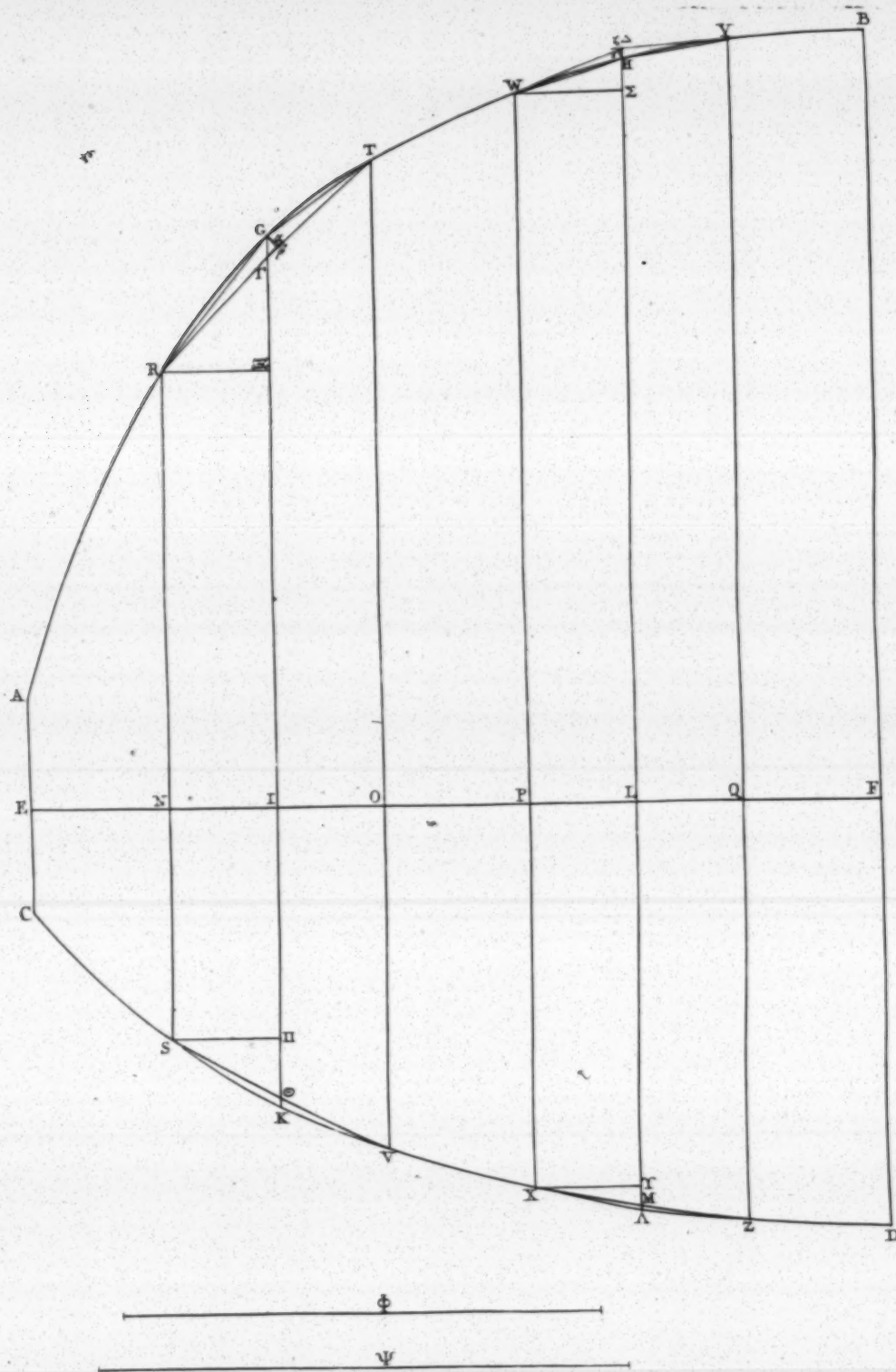
THE same things remaining as before, if one of the Curves includes the greatest space that can be included by a Curve generated in the manner proposed from any Curve of the same length with the other; the *Ratio* of the *Radius* of the Curvature of this latter Curve in any point to the *Radius* of the Curvature in any other point, will be compounded of the *Ratio* of the *Momentum* of its Ordinate in the first point to the simultaneous *Momentum* of the correspondent Ordinate of the former Curve, and of the *Ratio*, which the *Momentum* of the Ordinate in the former Curve corresponding to that Ordinate in the other Curve, which belongs to the second point, bears to the simultaneous *Momentum* of that Ordinate in the other Curve.

LET the two Curves be AB , CD , their common Abscisse EF , the space $E C D F$ the greatest that can be included by any Curve so generated from a Curve passing through the points A , B , and equal in length to this Curve Line AB , that every Ordinate in the Curve CD bear constantly the same relation to the adjoining Ordinate of the Curve AB , independent on any other variable Magnitude. Let any two points G , H , be taken in the Curve AB , and the Ordinates $G I K$, $H L M$ be drawn: Then I say the *Ratio* of the *Radius* of the Curvature in the point G to the *Radius* of the Curvature in the point H is compounded of the *Ratio* of the *Momentum* of $I G$ to the simultaneous *Momentum* of $I K$, and of the *Ratio* of the *Momentum* of $L M$ to the simultaneous *Momentum* of $L H$.

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If possible let the *Ratio* of the Radius of the curvature in *G* to the Radius of the curvature in *H* be less than that which is compounded of these two *Ratios*. Take on each side the point *I* two points *N*, *O* equally distant from it, and at the same distance from the point *L* take on each side of it two points *P*, *Q*; then



draw the Ordinates *RNS*, *TOV*, *WPX*, *YQZ*. Now if the Intervals *IN*, *IO* are diminished without limit, till they vanish, the Radius of the Curvature in the Point *G* will coincide with the Semidiameter of the Circle passing through the three Points *R*, *G*, *T*, and the Intervals *LP*, *LQ* being likewise diminished without limit till they vanish, the Radius of the Curvature in the Point *H* will coincide with the Semidiameter of the Circle passing through the three Points *W*, *H*, *T*.

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If therefore the *Ratio* of the Radius of the Curvature in the Point G to the Radius of the Curvature in H be less than the *Ratio*, which is compounded of the *Ratio* of the *Momentum* of IG to the *Momentum* of IK , and of the *Ratio* of the *Momentum* of LM to the *Momentum* of LH , the *Ratio* of the Semidiameter of the Circle passing through the three Points R, G, T , to the Semidiameter of the Circle passing through W, H, Y will be less than the *Ratio* compounded of the two forementioned *Ratios*. Having drawn the Chords RG, GT, WH, HY , take in IG the Point Γ within the Concavity of the Arch RGT , and in LH on the convex Side of the Arch WHY take the Point Δ ; so that $R\Gamma, \Gamma T, W\Delta, \Delta Y$ being drawn, the Sum of $W\Delta, \Delta Y$ shall exceed the Sum of WH, HY as much as the Sum of RG, GT exceeds the Sum of $R\Gamma, \Gamma T$; and moreover, that the *Ratio* of the Semidiameter of the Circle passing through the Points R, Γ, T to the Semidiameter of the Circle passing through W, Δ, Y shall likewise be less than that which is compounded of the two *Ratios* before mentioned, all which is evidently possible.

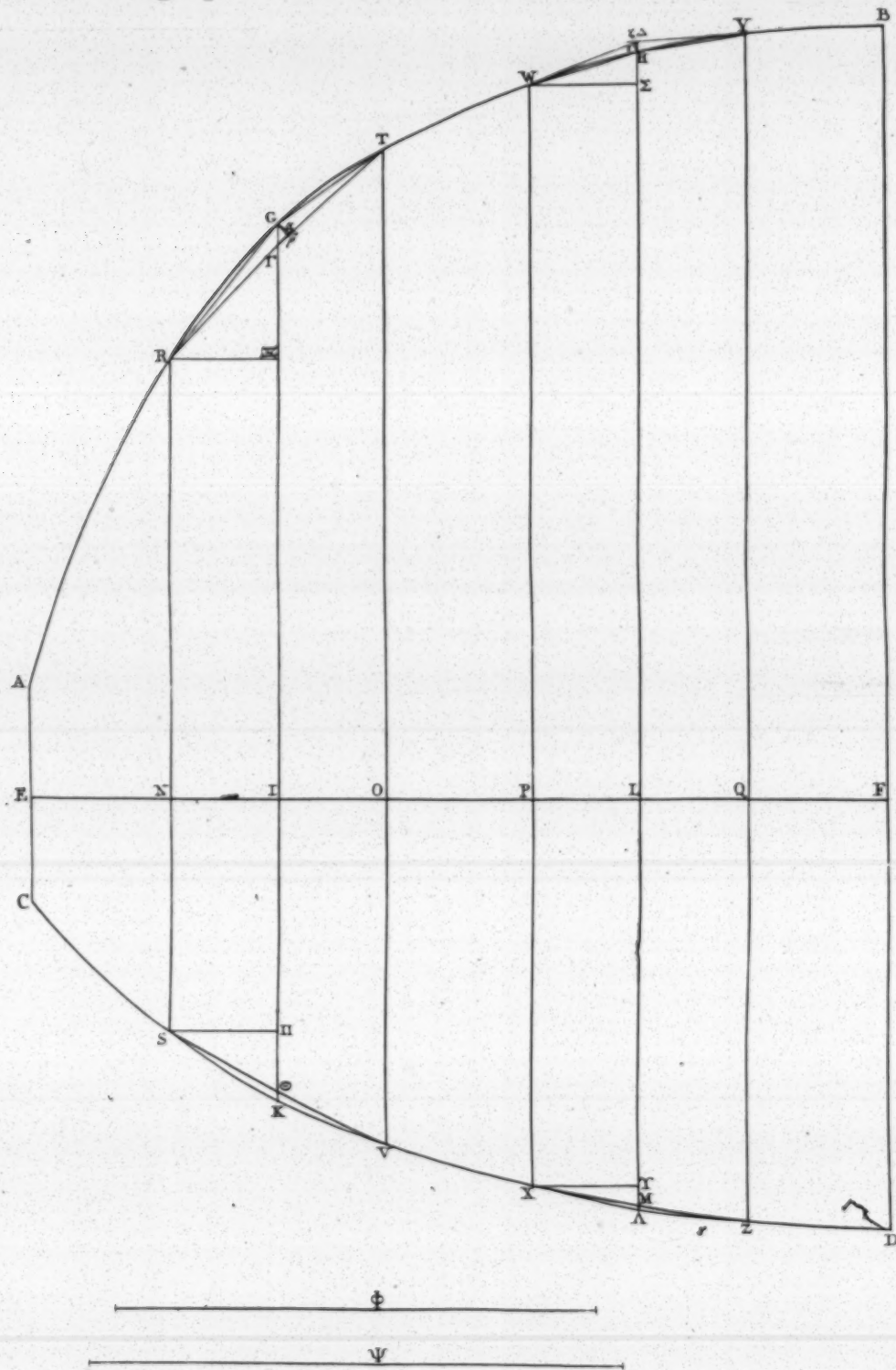
Now suppose two Arches to be described, one through the Points R, Γ, T , and the other through the Points W, Δ, Y , so that these Arches taken together shall be equal in length to the two Arches RGT, WHY taken together; and let two Arches $S\Theta V, X\Delta Z$ be generated from these Arches passing through R, Γ, T , and through W, Δ, Y in the same manner as the Arches SKV, XMZ are generated from the Arches RGT, WHY . Then since the Curve Line $CSKVXMZD$ comprehends a greater Space than any Curve that can be generated from another Curve of the same length with the Curve $ARGTWHYB$, by the same Rule as these two Curves depend on each other; and since the Curve Line $ARGTWHYB$ is equal in length to the Curve Line $AR\Gamma TW\Delta YB$, the Space included by the Curve Line $CSKVXMZD$ will be greater than that comprehended under the Line $CS\Theta V X\Delta ZD$, and consequently the Space $SKV\Theta S$ greater than the Space $XMZ\Delta X$: For by the preceding Proposition the Point Γ being taken within the Concavity of the Curve AB , $I\Theta$ is less than IK , and the Point Δ falling on the convex Side of the Curve AB , LM is less than $L\Delta$. But if the Points N, O and P, Q approach without limit till their Distance vanishes, the Curve Line SKV coincides with the Conic Parabola described to the Diameter IK through the three Points S, K, V ; and the Curve $S\Theta V$ coincides with the like Parabola described to the same Diameter through the Points S, Θ, V ; so likewise the Curve XMZ coincides with a Parabola described to the Diameter LM through the Points X, M, Z ; and lastly, the Curve $X\Delta Z$ agrees with a Parabola drawn through the Points X, Δ, Z , and having the same Diameter $L\Delta$. Hence the Space $SKV\Theta S$ being greater than the Space $XMZ\Delta X$, and NO equal to PQ , $K\Theta$ is greater than $M\Delta$.

FARTHER, draw $G\alpha$ perpendicular to $R\Gamma$, $G\beta$ perpendicular to ΓT , $H\epsilon$ perpendicular to $W\Delta$, and $H\zeta$ perpendicular to ΔY , then $R\alpha$ is less than RG , and $T\beta$ less than TG ; as likewise $W\epsilon$ less than WH , and $Y\zeta$ less than YH . Therefore

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fore the Excess of RGT above $R\Gamma T$ is greater than the Excess of the Sum of $R\alpha, \beta T$ above $R\Gamma T$, that is greater than the Difference between $\Gamma\alpha, \Gamma\beta$; and the Excess of $W\Delta Y$ above WHY is less than the Excess of $W\Delta Y$ above the Sum of $W\epsilon, \zeta Y$, or than the difference between $\Delta\epsilon, \Delta\zeta$: Hence the Excess of RGT above $R\Gamma T$ being equal to the Excess of $W\Delta Y$ above WHY , the difference between



$\Gamma\alpha, \Gamma\beta$ is less than the difference between $\Delta\epsilon, \Delta\zeta$. Again, the Semidiameter of the Circle passing through the three Points R, Γ, T is to half NO as GR to the difference between $\Gamma\alpha, \Gamma\beta$, and the Ratio of half PQ , equal to half NO , to the Semidiameter of the Circle passing through W, Δ, Y is the same with the Ratio of the difference between $\Delta\epsilon, \Delta\zeta$ to $H\Delta$, and therefore greater than the Ratio of the difference

difference between $\Gamma\alpha$, $\Gamma\beta$ to $H\Delta$. Consequently by equality the *Ratio* of the Semidiameter of the Circle passing through the three Points R , Γ , T to the Semidiameter of the Circle passing through W , Δ , Υ is greater than the *Ratio* of $G\Gamma$ to $H\Delta$: and moreover, $K\Theta$ being greater than $M\Delta$, the *Ratio* of the Semidiameter of the Circle passing through R , Γ , T to the Semidiameter of the Circle passing through W , Δ , Υ will still more exceed the *Ratio*, which is compounded of the *Ratio* of $G\Gamma$ to $K\Theta$, and of the *Ratio* of $M\Delta$ to $H\Delta$.

IN the next place let $R\xi$, $S\Pi$, $W\Sigma$, $X\Upsilon$ be drawn parallel to the Abscisse EF ; then because IG , $I\Gamma$, NR bear to IK , $I\Theta$, NS the same relation respectively without regard to any other variable Magnitude, the ultimate *Ratio* of $G\Gamma$ to $K\Theta$ will not differ from the ultimate *Ratio* of $G\xi$ to $K\Pi$. For the same reason the ultimate *Ratio* of $M\Delta$ to $H\Delta$ will not differ from the ultimate *Ratio* of $M\Upsilon$ to $H\Sigma$. Hence the *Ratio* of the Semidiameter of the Circle passing through R , Γ , T to the Semidiameter of the Circle passing through W , Δ , Υ being greater than the *Ratio* compounded of the *Ratio* of $G\Gamma$ to $K\Theta$, and the *Ratio* of $M\Delta$ to $H\Delta$ the same will be greater than the *Ratio* compounded of the ultimate *Ratio* of $G\xi$ to $K\Pi$, and of the ultimate *Ratio* of $M\Upsilon$ to $H\Sigma$, the ultimate *Ratio* of $G\xi$ to $K\Pi$ being that of the *Momentum* of IG to the simultaneous *Momentum* of IK , and the ultimate *Ratio* of $M\Upsilon$ to $H\Sigma$ being that of the *Momentum* of LM to the simultaneous *Momentum* of LH . But it was said above, that the *Ratio* of the Semidiameter of the Circle passing through R , Γ , T to the Semidiameter of the Circle passing through W , Δ , Υ was less than the *Ratio* compounded of the *Ratio* of the *Momentum* of IG to the simultaneous *Momentum* of IK , and of the *Ratio* of the *Momentum* of LM to the simultaneous *Momentum* of LH ; which is a Repugnancy.

THEREFORE the *Ratio* of the Radius of the Curvature in G to the Radius of the Curvature in H is not less than the *Ratio* compounded of the *Ratio* of the *Momentum* of IG to the simultaneous *Momentum* of IK , and of the *Ratio* of the *Momentum* of LM to the simultaneous *Momentum* of LH . And for the same reason neither is the *Ratio* of the Radius of the Curvature in H to the Radius of the Curvature in G less than the *Ratio* compounded of the *Ratio* of the *Momentum* of LH to the simultaneous *Momentum* of LM , and of the *Ratio* of the *Momentum* of IK to the simultaneous *Momentum* of IG . Whence the Proposition is manifest.

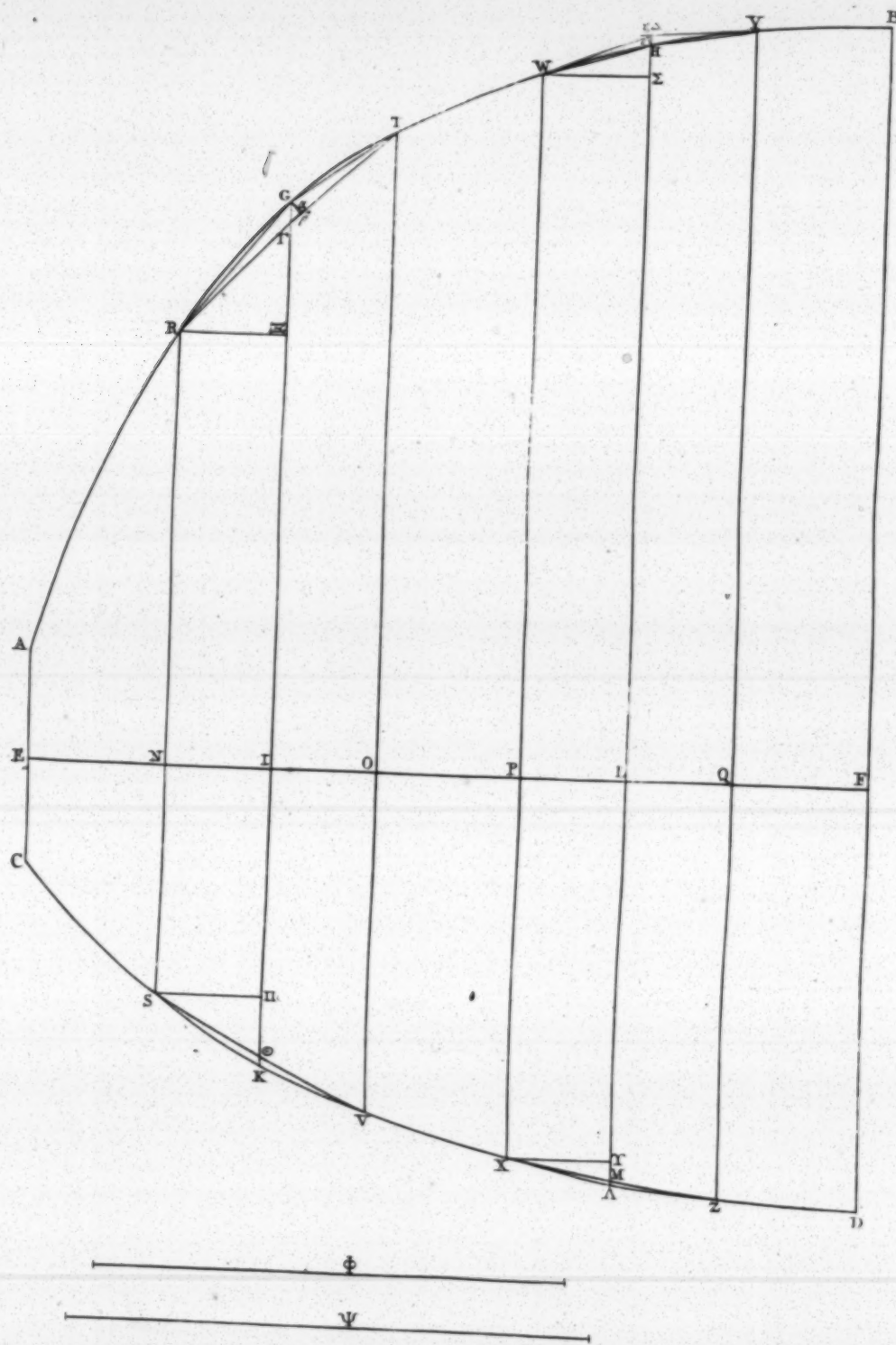
PROPOSITION IV.

THE same things remaining, I say the Radius of the Curvature in every Point of the Curve AB is to one and the same Line as the *Momentum* of its Ordinate in that Point to the simultaneous *Momentum* of the correspondent Ordinate in the Curve CD .

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If not, let the Radius of the Curvature in the Point G be to the Line Φ as the *Momentum* of the Ordinate IG to the simultaneous *Momentum* of the Ordinate IK , and the Radius of the Curvature in the Point H be to some other Line Ψ as the *Momentum* of the Ordinate LH to the simultaneous *Momentum* of the Ordinate LM ; then the *Ratio* of the Radius of the Curvature in G to the Radius of the



Curvature in H not being compounded of the *Ratio* of the first Radius to Φ , and of the *Ratio* of Ψ to the second Radius, the same will not be compounded of the *Ratio* of the *Momentum* of IG to the simultaneous *Momentum* of IK , and of the *Ratio* of the *Momentum* of LM to the simultaneous *Momentum* of LH ; which is absurd.

m

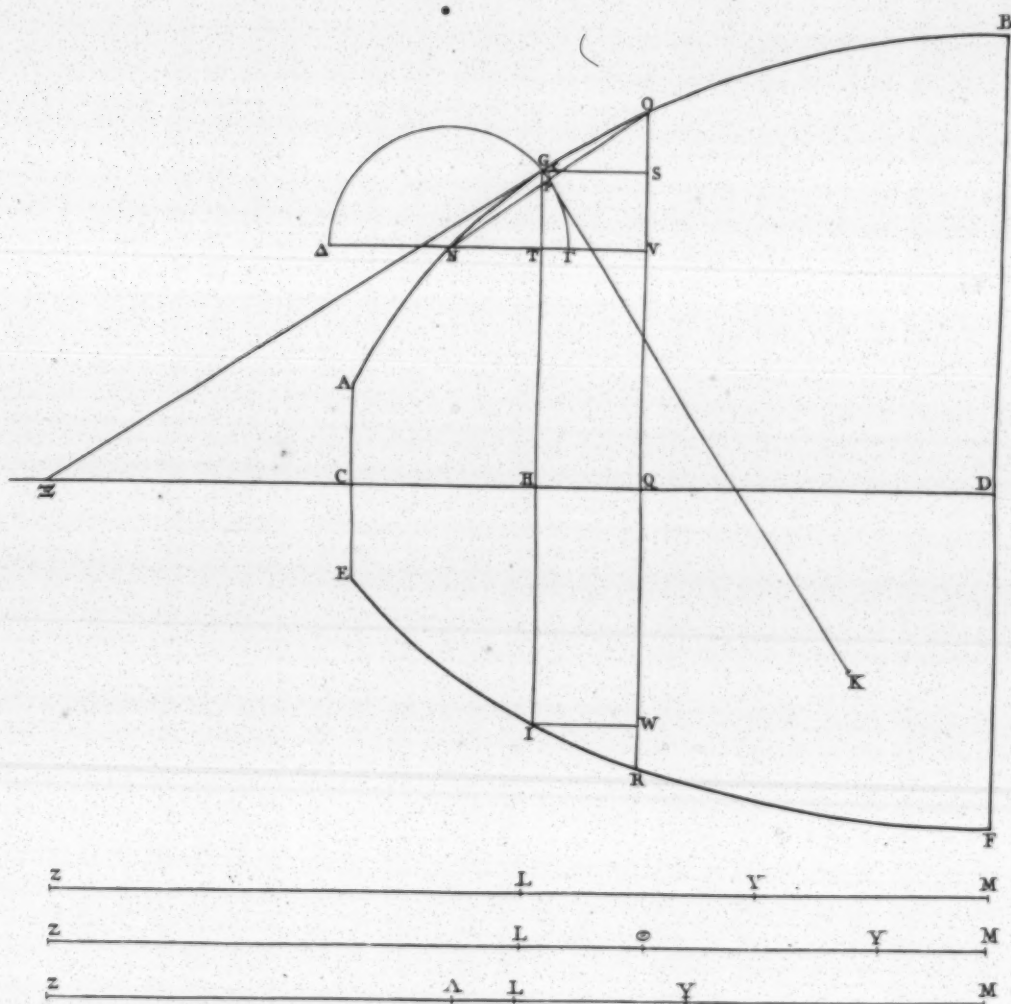
PROPO-

PROPOSITION V.

IN the Curve, which of all Curves of the same length with it self generates the greatest Space in the manner before specified, to assign the relation between the *Momentum* of the Curve, of its Ordinate, and of its Abscisse.

LET the Curve be AB , the Abscisse CD , the Space generated from it $CEFD$. Any point G being taken in the Curve AB , ordinately apply GH , and draw GK the Radius of the Curvature in the point G ; then this Radius of the Curvature will be to some certain Line, which in every point of the Curve AB is the same, suppose to the Line LM , as the *Momentum* of the Ordinate GH to the simultaneous *Momentum* of the correspondent Ordinate HI . Take in the Curve AB the points N, O equally distant from G , drawing NPO , ordinately applying OQR to the Abscisse CD , and drawing GS , NTV , IW parallel to CD , as also Px parallel to GH . This being done, if the points N, O approach to G , till their distance from it vanishes, the ultimate *Ratio* of twice GK to GO will be the same with the ultimate *Ratio* of OG to GP ; but the ultimate *Ratio* of OG to OS is the same with the *Ratio* of GP to Gx ; therefore by Equality the ultimate *Ratio* of twice GK to OS is the same as the ultimate *Ratio* of GO to Gx , and by Permutation the ultimate *Ratio* of twice GK to GO is the same as the ultimate *Ratio* of OS to Gx ; as also, GK being to twice GK as Gx to twice Gx , by Equality the ultimate *Ratio* of GK to GO is the same as the ultimate *Ratio* of OS to twice Gx . Again, the ultimate *Ratio* of OS to WR is the *Ratio* of the *Momentum* of GH to the simultaneous *Momentum* of HI ; therefore because GK , the Radius of the Curvature in the point G , is to LM as the *Momentum* of GH to the *Momentum* of HI , GK will be to LM in the ultimate *Ratio* of OS to WR , and by Inversion LM will be to GK in the ultimate *Ratio* of WR to OS ; but the ultimate *Ratio* of GK to GO has been proved to be the same with the ultimate *Ratio* of OS to twice Gx ; therefore by Equality the ultimate *Ratio* of LM to GO will be the same with the ultimate *Ratio* of WR to twice Gx . But moreover, NG and GO being equal, NP and PO are likewise equal; insomuch that xS is equal to half NV , and Gx equal to half the Difference between NT and GS . Whence if the point G be supposed to flow, and the Curve AG to increase uniformly, the ultimate *Ratio* of OS to Gx will be that of the *Momentum* of GH to half the momentaneous Increment or Decrement of NT , and the ultimate *Ratio* of WR to twice Gx will be that of the momentaneous Increment or Decrement of HI to the momentaneous Increment or Decrement of NT . Now whereas it has been demonstrated that the Curve AB is concave towards its Abscisse, when the Ordinates GH, HI increase or decrease together, but convex towards its Abscisse, when one of these Ordinates increases at the same time that the other decreases, it is evident that NT and HI in every Case increase and decrease together. But moreover, if the Curve AG increases uniformly, the ultimate *Ratio* of LM to GO will be

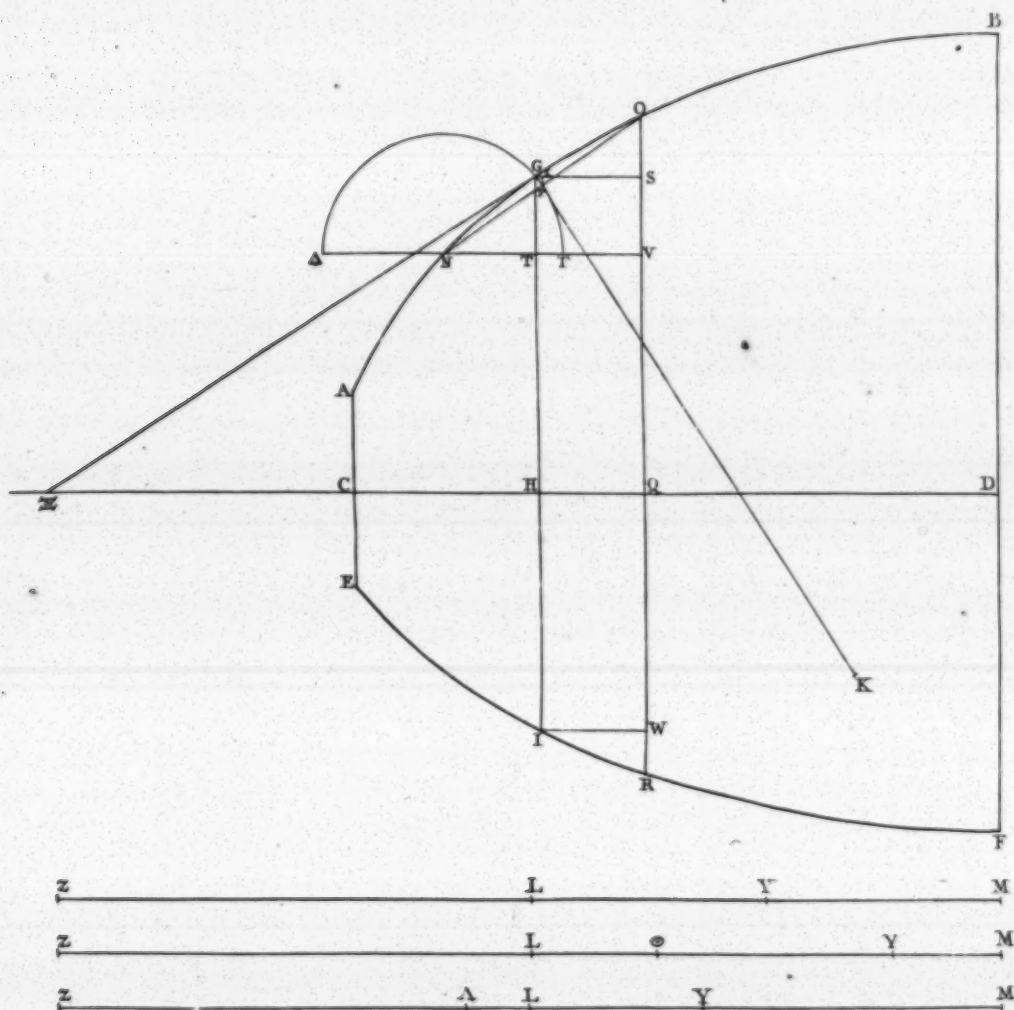
be always the same; therefore, since the ultimate *Ratio* of LM to GO is the same with the ultimate *Ratio* of RW to twice Gx , or with the *Ratio* of the *Momentum* of HI to the *Momentum* of NT , all which appears from what has been said above; it follows that the ultimate *Ratio* of LM to GO , may either be the same with the ultimate *Ratio* of HI to NT ; or the same with the ultimate *Ratio* of HI together with some given Line to NT ; or lastly, the same with the ultimate *Ratio* of the Excess of HI above some given Line to NT .



IN the first place let the ultimate *Ratio* of LM to GO be the same with the ultimate *Ratio* of HI to NT . Take LT equal to HI ; then the ultimate *Ratio* of LM to GO or GN will be the same with the ultimate *Ratio* of LY to NT , and by Permutation the *Ratio* of LM to LY will be the same with the ultimate *Ratio* of GN to NT ; therefore LZ being made equal to LM by Composition and Division, the *Ratio* of ZY to YM will be the same with the ultimate *Ratio* of the Sum of GN and NT to the Difference between them. But the Semicircle ΔGT being described to the Center N , it appears that GT is a mean Proportional between ΔT and TT , that is between the Sum and Difference of GN and NT . Hence the *Ratio* of ZY to YM is duplicate of the ultimate *Ratio* of the Sum of GN and NT to GT , and also duplicate of the ultimate *Ratio* of GT to the Difference

ference between BN and NT ; that is, the *Ratio* of ZT to TM is duplicate of the *Ratio* of the Sum of the *Momentum* of the Curve AG , and of the Abscisse CH to the *Momentum* of the Ordinate HG ; and the same *Ratio* also duplicate of the *Ratio* of the *Momentum* of the Ordinate HG to the Difference between the *Momentum* of the Curve AG , and of the Abscisse CH . And thus is the relation between these *Momenta* assigned in this first Case.

IN the next place, let the ultimate *Ratio* of LM to GO be the same with the ultimate *Ratio* of HI together with some given Line to NT . Let this given



Line be $L\Theta$, and take ΘY equal to HI . Then will the ultimate *Ratio* of LM to GO or GN likewise be the same with the ultimate *Ratio* of LY to NT , and as before taking LZ equal to LM , the *Ratio* of ZY to YM will be duplicate of the *Ratio* of the Sum of the *Momentum* of the Curve AG and of the Abscisse CH to the *Momentum* of the Ordinate HG , and the same *Ratio* also duplicate of the *Ratio* of the *Momentum* of the Ordinate HG to the Difference between the *Momentum* of the Curve AG and of the Abscisse CH . Thus the relation of these *Momenta* is assigned in this second Case.

LASTLY,

LASTLY, let the ultimate *Ratio* of LM to GO be the same with the ultimate *Ratio* of the Excess of HI above some given Line to NT . Let LA be that Line, and AY be taken equal to HI ; then is the ultimate *Ratio* of LM to GO or GN in like manner the same with the ultimate *Ratio* of LY to NT ; and as before, LZ being taken equal to LM , the *Ratio* of ZY to YM is duplicate of the *Ratio* of the Sum of the *Momentum* of the Curve AG and of the Abscissa CH to the *Momentum* of the Ordinate HG ; the same *Ratio* being also duplicate of the *Ratio* of the *Momentum* of the Ordinate HG to the Difference between the *Momentum* of the Curve AG and of the Abscissa CH . And hence the relation between these *Momenta* is assign'd in this last Case.

COROLLARY.

IF GZ be drawn to touch the Curve AB in the point G ; because the ultimate *Ratio* of LM to GO is the same with the ultimate *Ratio* of LY to NT , and by Permutation LM to LY in the ultimate *Ratio* of GO to NT , GZ will be to HZ as LM to LY .

THUS much concerning Isoperimetrical Curves in general will suffice for our present Purpose; as to what farther relates to these Curves, the great Geometers, who have already treated of them, may be consulted*. I shall now proceed forthwith to apply what has been here delivered to the Subject under Consideration.

PROPOSITION VI.

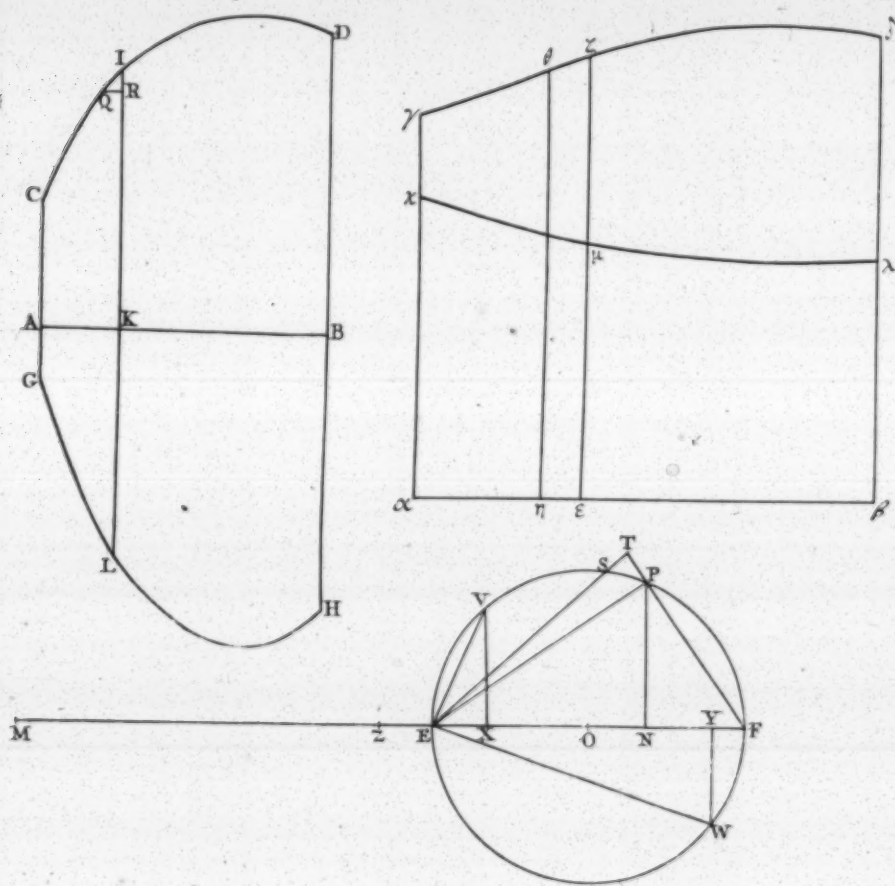
TO a given Axis to describe a Curve through two given Points, so that Perpendiculars being let fall from those Points upon the Axis, the Space included by those Perpendiculars, by the Axis, and by the Curve to be described, shall generate in revolving round the Axis a greater Solid, than can be generated by any Space included under the same Axis, the same Perpendiculars, and any other Curve Line of the same length with the Curve to be described, and passing through the same given Points.

LET the given Axis be AB , the Points given C, D , from whence are drawn CA, DB perpendicular to the Axis, and let it be required to describe the Curve CD having the Property here specify'd.

* The two *Bernoulli's* and *Dr. Taylor*.

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TAKE at pleasure the Line EF , and let the Curve GH be such, that any point I being taken in the Curve CD , and the Ordinate IKL being drawn, the Rectangle under KL , and a Line equal to half the Circumference of the Circle described with the Radius EF be equal to the Circle described by IK in the Revolution



of the Space $ACDB$ about the Axis AB . Then the solid generated by the Revolution of the space $ACDB$ about AB shall be equal to the Solid whose Base is the Space $AGHB$, and Altitude equal to half the forementioned Circumference. And whereas the Solid generated by the Curve CD , is to be greater than the Solid generated in like manner by any other Curve drawn through the Points C, D , of the same Length with CID ; therefore the Solid whose Base is the Space $AGHB$, and Altitude that now mentioned, and consequently the Space it self $AGHB$, must be greater than can be produced by Curves derived from any other Curve passing through the Points C, D , and of the same Length with the Curve CD , those Curves being derived from such a Curve in the same manner as the Curve GH is derived from the Curve CD . Moreover, because the Circle described by IK is equal to the Rectangle under IK , and a Line equal to half the Circumference described by the Point I , and the Circumferences of Circles are proportional to their Diameters; since the Circle described by IK is equal to the Rectangle under KL , and half the Circumference of a Circle whose Radius is EF , therefore the Square of IK will be equal to the Rectangle under KL and EF . But because the Space $AGHB$ is greater than any other, that can be comprehended by Curves deduced as aforesaid from any other Curve of equal Length with CD ; if any Point

M

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M be taken in the Line FE , and EN be taken equal to KL , the momentaneous Increment of the Sum of DI and BK may be to the *Momentum* of KI in the subduplicate *Ratio* of MN to NF ; and the *Ratio* of the *Momentum* of IK to the momentaneous Increment of the Difference between DI and BK subduplicate of the same.

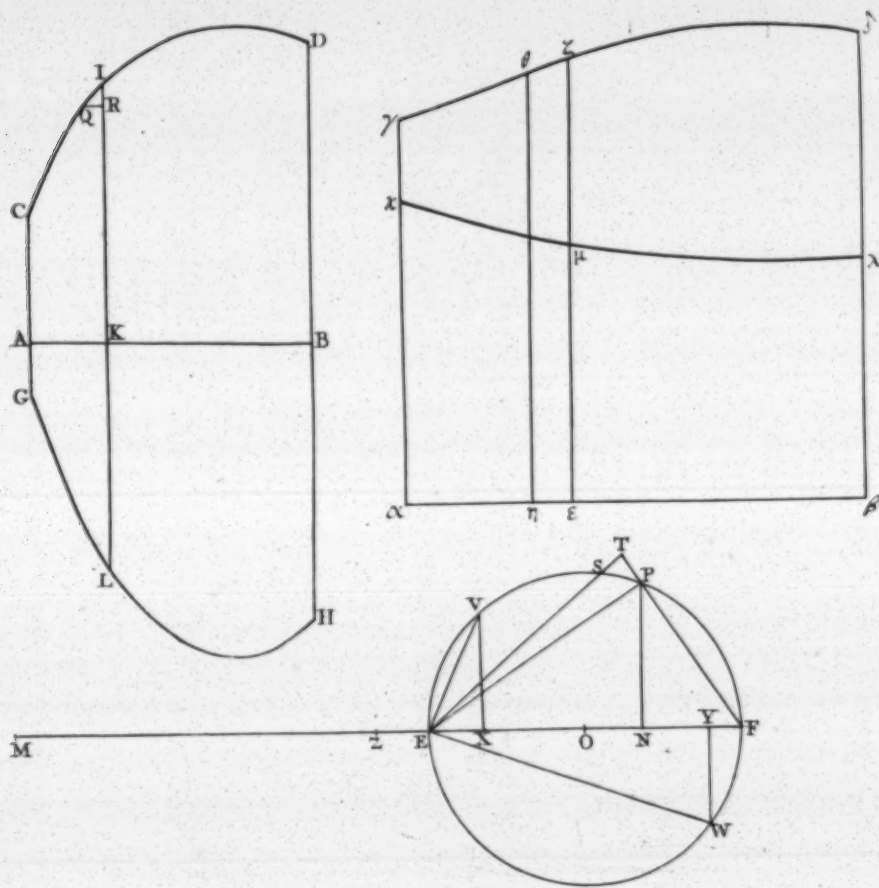
UPON EF as a Diameter describe a Circle, its Center being O , erect NP perpendicular to EF , drawing EP . Then because the Square of IK is equal to the Rectangle under KL , EF , and the Square of EP equal to the Rectangle under FEN ; EN being taken equal to KL , EP shall be equal to KI . Farther, take in the Curve DI the point Q , and draw QR parallel to AB , and likewise in the Circle EPF , draw ES equal to KR , and also FPT .

Now it has been declared, that the ultimate *Ratio* of the Sum of IQ and QR to IR may be taken subduplicate of the *Ratio* of MN to NF , and the ultimate *Ratio* of IR to the Difference between IQ and QR subduplicate of the same. But if the Points S and P approach without Limit, the ultimate *Ratio* of EP to ET shall be the *Ratio* of Equality, and ST equal to IR , because the Angle under EPF in the Semicircle is a right one. Hence the ultimate *Ratio* of the Sum of IQ and QR to ST may be subduplicate of the *Ratio* of MN to NF . But the ultimate *Ratio* of ST to PS is the same with the *Ratio* of PF to FE , by reason that the Triangle TPS , when it vanishes, becomes similar to the Triangle FEP ; and NF being to FP as PF to FE , the *Ratio* of PF to EF is subduplicate of the *Ratio* of NF to FE ; therefore the ultimate *Ratio* of ST to PS is subduplicate of the *Ratio* of NF to FE . Whence when the ultimate *Ratio* of the Sum of IQ and QR to ST is subduplicate of the *Ratio* of MN to NF , by Equality the ultimate *Ratio* of the Sum of IQ and QR to PS will be subduplicate of the *Ratio* of MN to EF .

Now in the Circle EPF draw EV equal to AC , and EW equal to BD , letting fall the Perpendiculars VX and WT . Then taking the Line $\alpha\beta$ equal to the Arch VFW , erect the Perpendiculars $\alpha\gamma$, $\beta\delta$, that $\alpha\gamma$ be a mean proportional between MX and EF , and $\beta\delta$ a mean proportional between MY and EF . Moreover, taking $\beta\epsilon$ equal to the Arch WFP , and the Perpendicular $\epsilon\zeta$ equal to the mean proportional between MN and EF , describe the Curve $\gamma\zeta\delta$, that shall pass through all the Points found in the same manner as ζ . This being done, take $\epsilon\eta$ equal to PS , and erect $\eta\theta$. And since the ultimate *Ratio* of the Sum of IQ , QR to PS may be subduplicate of the *Ratio* of MN to EF , it may be the same with the *Ratio* of $\epsilon\zeta$ to EF , this last *Ratio* being subduplicate of the *Ratio* of MN to EF , by reason that $\epsilon\zeta$ is the mean proportional between MN and EF . But when the ultimate *Ratio* of the Sum of IQ , QR to PS is the same with the *Ratio* of $\epsilon\zeta$ to EF , the Rectangle under EF and the Sum of IQ , QR will be equal to the Rectangle under $\epsilon\zeta$ and PS or $\epsilon\eta$, when these Rectangles vanish.

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nish. Consequently the Rectangle under EF and the Sum of DI , BK is equal to the Space $\beta\delta\zeta\epsilon$. And thus may be assigned the Sum of any Portion of the Curve and of the Correspondent Abscisse.



AGAIN, the ultimate *Ratio* of the Sum of IQ , QR to IR being subduplicate of the *Ratio* of MN to NF , and the ultimate *Ratio* of IR to the Difference between IQ , QR subduplicate of the same; the ultimate *Ratio* of the Sum of IQ , QR to the Difference between them is the same as the *Ratio* of MN to NF , and by Composition the ultimate *Ratio* of the Sum of IQ , QR to twice IQ the same with the *Ratio* MN to MF ; and likewise, if MF be divided into two equal Parts in Z , the ultimate *Ratio* of the Sum of IQ , QR to IQ will be the same with the *Ratio* of MN to ZF . But the ultimate *Ratio* of the Sum of IQ , QR to IR being the subduplicate of the *Ratio* of MN to EF , and $\epsilon\zeta$ the mean proportional between MN and EF , the ultimate *Ratio* of IR to the Sum of IQ , QR will be the same with the *Ratio* of $\epsilon\zeta$ to MN ; therefore since the ultimate *Ratio* of the Sum of IQ , QR to IQ is the same with the *Ratio* of MN to ZF ; by Equality the ultimate *Ratio* of IR or PS to IQ will be the same with the *Ratio* of $\epsilon\zeta$ to ZF .

THEREFORE let $\alpha\kappa$ be taken to EF as ZF to $\alpha\gamma$, $\beta\lambda$ to EF as ZF to $\beta\delta$; likewise $\epsilon\mu$ to EF as ZF to $\epsilon\zeta$, and let the Curve $\kappa\mu\lambda$ be described, that shall pass through all the points found as μ . Which being done, since the ultimate *Ratio* of PS or $\epsilon\eta$ to IQ is the same with the *Ratio* of $\epsilon\zeta$ to ZF , it will be the same with the *Ratio* of EF to $\epsilon\mu$, and the Rectangle under $\epsilon\eta$, $\epsilon\mu$, or the Space $\eta\mu$, equal

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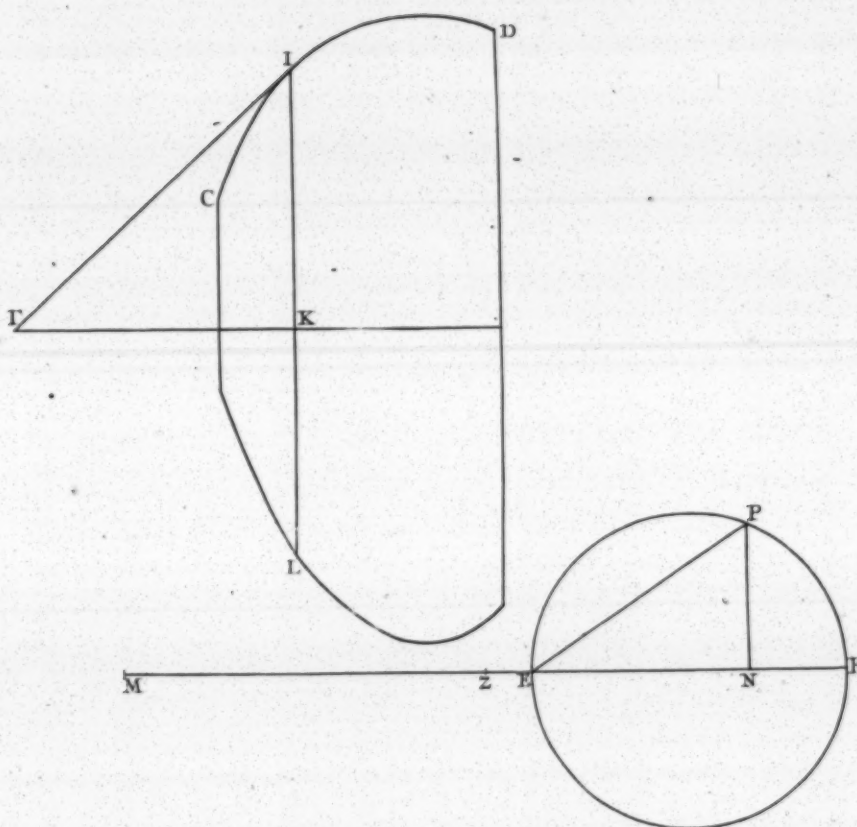
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equal to the Rectangle under EF , IQ ; so that the Space $\beta\epsilon\mu\lambda$ will be equal to the Rectangle under EF and DI . Thus may be found the Length of any Portion DI of the Curve DC corresponding to any given Ordinate IK , as before was assigned the Sum of the Curve DI and of its Abscisse BK .

HENCE to any given Ordinate IK the correspondent Abscisse BK may be found; and the Curve commodiously be described; the Spaces $\alpha\gamma\delta\beta$, $\alpha\kappa\lambda\beta$ being measured by Sir *Isaac Newton's* Method of Differences with great Facility.

COROLLARY I.

MF being divided into two equal Parts in Z ; since EN is equal to KL , if

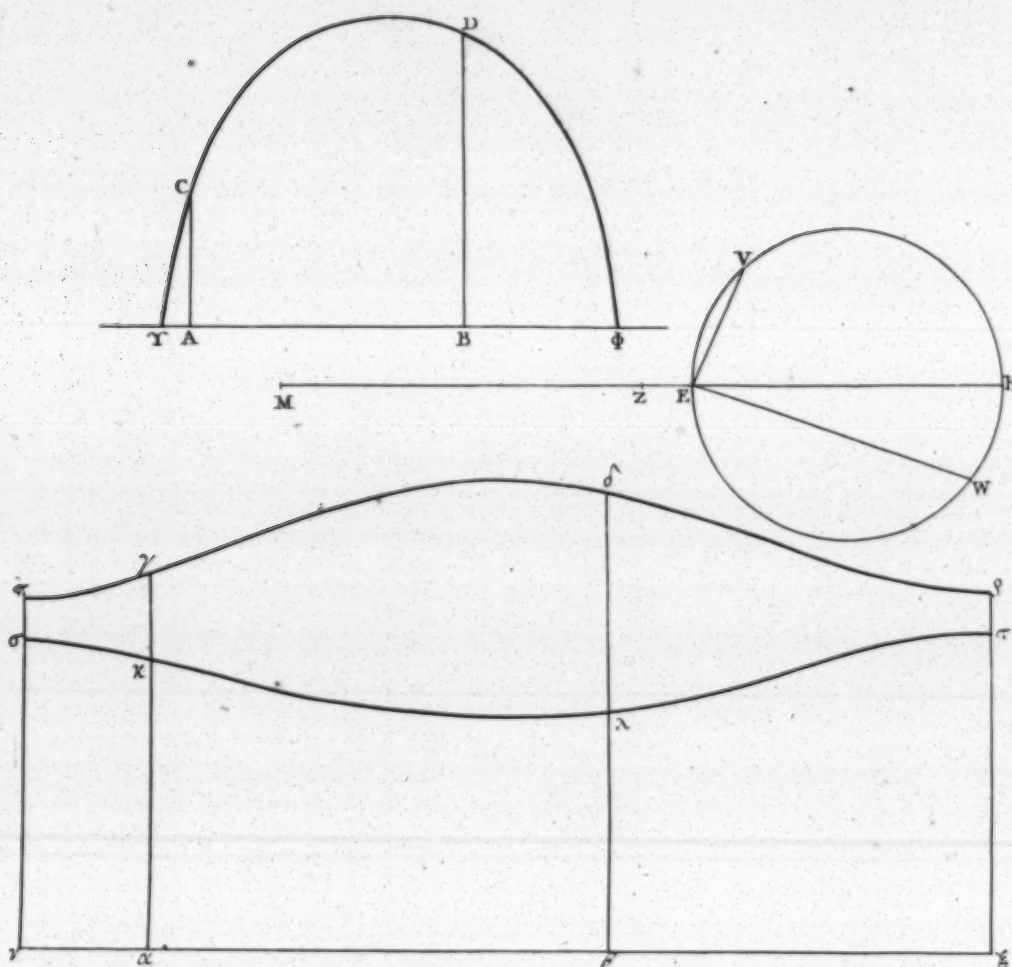


IR be drawn to touch the Curve CD in I , IR shall be to IK as ZF to ZN .

COROLLARY

COROLLARY II.

If $\alpha\beta$ be produced both ways, that $\alpha\nu$ be equal to the Arch VE , and $\beta\xi$ e-



qual to the Arch WE , completing the Curves $\pi\gamma\delta\rho$, $\sigma\kappa\lambda\tau$, the Curve CD may be continued on both Sides to the Axis in Υ and Φ .

COROLLARY III.

If ME be greater than EF , so that Z fall without the Circle, the right Lines that touch the Curve $\Upsilon CD \Phi$ in Υ and Φ shall make with the Axis an acute Angle towards the Curve; the Cosine of which Angle will be to the Radius as ZE to ZF . If ME be less than EF the same Angle shall be obtuse; but the Cosine thereof to the Radius in the same Proportion as before. Lastly, if ME be equal to EF the Tangents of the Curve in Υ and Φ shall be perpendicular to the Axis.

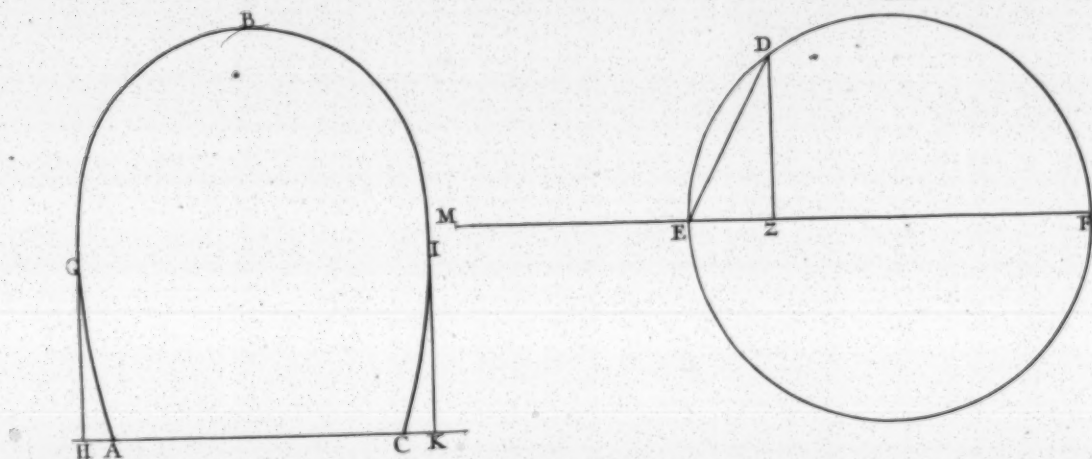
COROLLARY

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COROLLARY IV.

WHEN ME is less than EF an Ordinate may be drawn on each Side the Curve, that shall touch it. Let ABC be a Curve described with ME less than



EF ; from the Point Z erect the perpendicular ZD and draw ED ; then each of the Ordinates GH , IK , that are equal to ED , shall touch the Curve.

PROPOSITION VII.

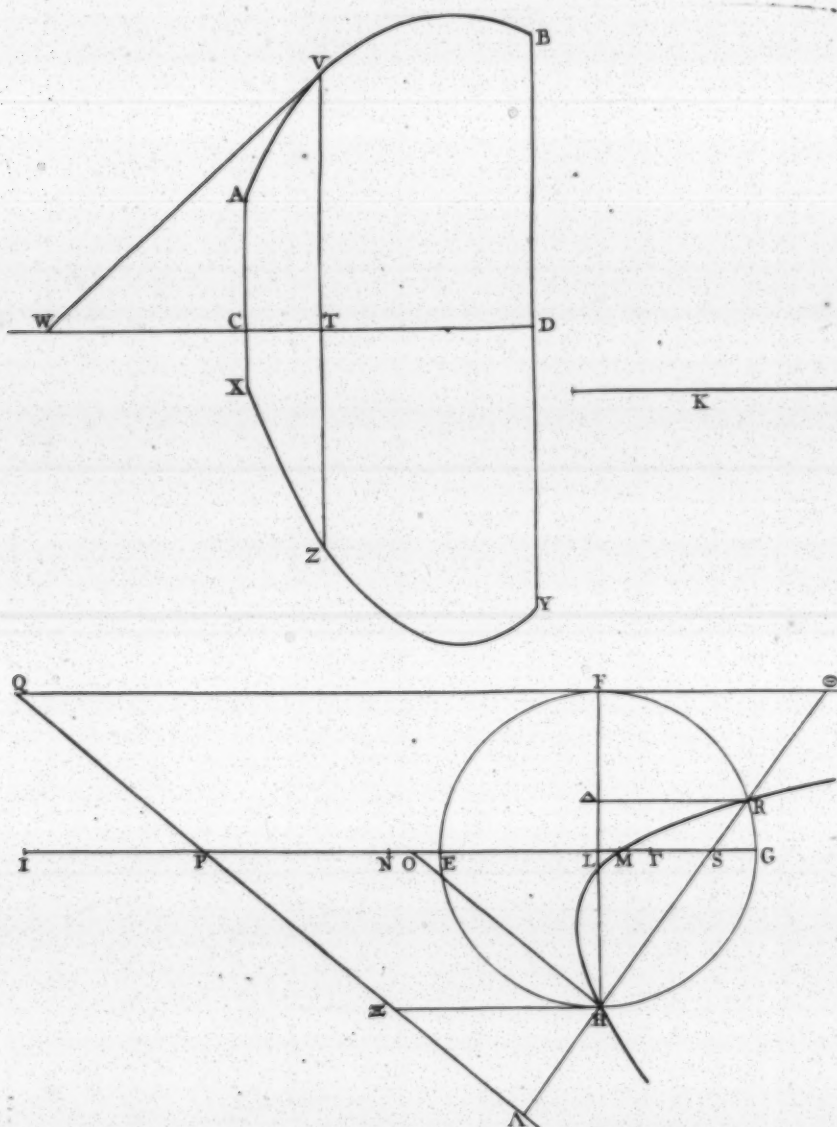
TO draw a Tangent to the Curve described in the preceding Proposition, that the Segment of the Axis intercepted between this Tangent and the Ordinate applied at the Point of Contact shall be equal to any Line proposed.

LET AB be the Curve, CD its Axis, $EFGH$ the Circle by which it is described, the Diameter of this Circle being EG , and I the Point assumed in that Diameter in order to the Description of the Curve AB ; and lastly let K be the Line equal to the Segment of the Axis CD that is to be intercepted between the Tangent to be drawn, and the Ordinate applied in the Curve AB at the Point of Contact.

IN the Circle $EFGH$ draw the Diameter FLH at Right Angles to EG ; take GM a third Proportional to IG and GE ; and IG being divided into two equal Parts in N , take likewise MO a third Proportional to NG and K , joining HO ; then take OP equal to MO ; and draw FQ , QP , the first of these Lines parallel to EG , but the latter parallel to HO . This being done to the Asymptotes QF , QP describe through the Point H the Hyperbola HR to meet the Circle $EFGH$ in R , and draw HSR . Then in the Curve AB the Ordinate TV being applied, that shall be a mean Proportional between IG and MS , and the Tangent VW being drawn, I say WT , the Segment of the Axis CD intercepted

cepted between this Tangent and the Ordinate VT , shall be equal to the Line K .

LET the correspondent Curve XY be drawn, and the Ordinate VT be produced to Z , and in the Line IG let NR be taken equal to TZ ; then will the Square of VT be equal to the Rectangle under $GE\Gamma$, and VW be to WT as NG to NR . But IG being to GE , or NG to LG , as EG to GM , NG will be to LG as NE to LM . Again, the Square of the Ordinate VT being equal to the Rectangle under $GE\Gamma$, and the same Ordinate VT being also the mean Proportional between IG and MS , the Rectangle under $GE\Gamma$ is equal to that under



IG, MS, infomuch that *IG* will be to *GE*, or *NG* to *LG*, as *ER* to *MS*; and therefore *NG* being to *LG* as *NE* to *LM*, as *NG* to *LG* so will *NR* be to *LS*, and by Permutation *NG* will be to *NR*, that is the Tangent *VW* to the Segment *WT* of the Axis, as *LG* or *HL* to *LS*; or, *RΔ* being drawn parallel to *EG*, as *HΔ* to *ΔR*. But now the Ratio of *HΔ* to *ΔF* is duplicate of the Ratio of *HΔ* to *ΔR*. Whence as the Square of *VW* to the Square of *WT*, so is *HΔ* to *ΔF*, and by Division as the Square of *VT*, that is the Rectangle under *IG, MS*, to the Square of *WT*, so is twice *LΔ* to *ΔF*, and taking half the Antecedents as the Rectangle

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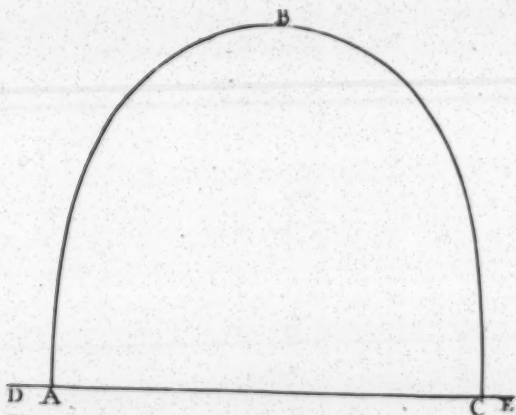
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Rectangle under NG , MS to the Square of WT so is $L\Delta$ to ΔF . Moreover, produce HR on both Sides to Θ and Λ , and draw $H\Xi$ parallel to EG , then ΘR by reason of the Hyperbola will be equal to $H\Lambda$. But as HS to $H\Lambda$ so is OS to $H\Xi$, $H\Xi$ being equal to OP or OM ; and as HS to $R\Theta$ so is HL to $F\Delta$. Therefore as HL or LF to $F\Delta$ so is OS to OM , and by Division as $L\Delta$ to $F\Delta$ so is MS to OM , and so likewise is the Rectangle under NG , MS to that under NG , OM , which is equal to the Square of K . But it has been proved, that the Rectangle under NG , MS is to the Square of WT as $L\Delta$ to ΔF ; so that the Rectangle under NG , MS will be to the Square of WT as the same Rectangle under NG , MS to the Square of K . Therefore WT is equal to K .

PROPOSITION VIII.

OF all the Curves described by the sixth Proposition, and continued to their Axes, that Curve, whose Tangents in the Points where it meets its Axis, are perpendicular to the said Axis, will by revolving about its Axis, generate a greater Solid than any other Curve whatever adapted to the same Axis, and of the same Length with this.

LET the Curve ABC be described to the Axis DE by the sixth Proposition, so that the Tangents in the Points A , C be perpendicular to DE ; I say

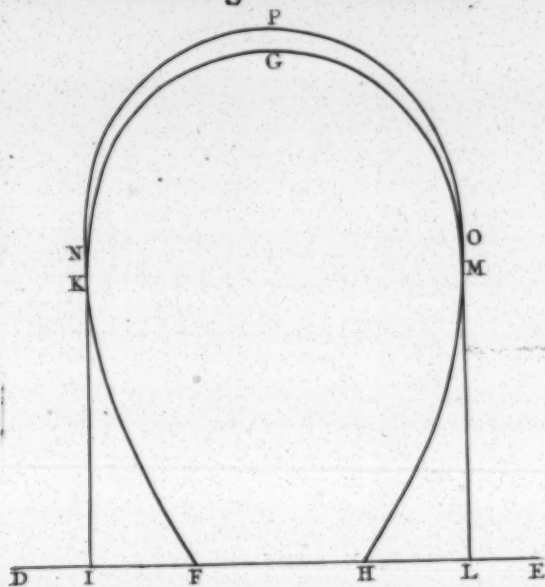


this Curve, by revolving round the Axis AC , shall generate a greater Solid than can be generated by any other Curve of the same Length with this, and described through any other two Points in the Axis DE .

IF this be not so, some other Curve adapted to the Axis DE , will produce the greatest Solid, that can be formed by Curves of the same Length with its self adapted to this Axis.

SUPPOSE therefore FGH to be such a Curve. It is evident that this Curve must be one of those, that would be described by the sixth Proposition through the
P Points

Points F, H ; for otherwise a Curve might be described through these Points of the same Length with this, which should produce a greater Solid. But it is farther manifest, that the Tangents to this Curve in the Points F, H will make towards the Curve either obtuse or acute Angles with the Axis.



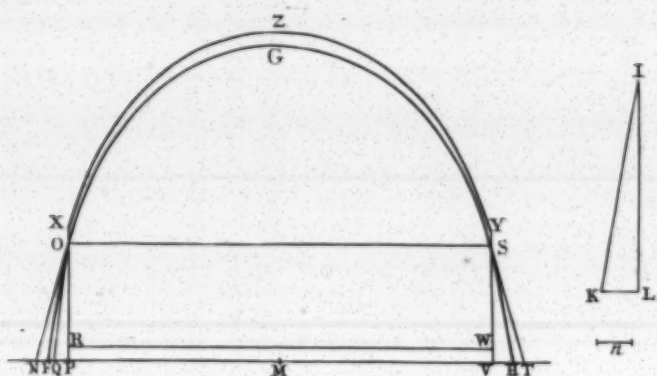
IN the first Place, let those Tangents make obtuse Angles: I say another Curve of the same Length with the Curve FGH may be fitted to this Axis, that shall generate a greater Solid than this Curve will generate.

DRAW the Ordinates IK and LM , that shall touch the Curve FGH as in K and M ; take IN equal to the Arch KF and LO equal to the Arch MH , drawing the Arch NPO similar and equal to the Arch KGM . Then it is evident that the Figure $INPOL$ by revolving about the Axis IL will generate a greater Solid than the Figure $FKGMH$, wholly included within this other, can generate by revolving about the same Axis; but the Perimeter of this Figure $INPOL$ excepting the Base, is equal to the Curve Line FGH ; and moreover, a Curve may be described through the Points I, L , of the same Length with the Line $INPOL$, or with FGH , that shall generate a greater Solid than the Figure $INPOL$ will generate. Consequently the Curve FGH will by no means generate the greatest Solid, that can be produced by Curves of the same Length with its self, and adapted to the same Axis.

AGAIN, let the Tangents of the Curve FGH in the Points F, H make with the Axis acute Angles towards the Curve. I say neither will this Curve generate the greatest Solid, that can be generated by any Curve of the same Length with this.

LET the Angle under IKL be equal to that, which the Tangents in F and H make with the Axis. Draw the perpendicular IL , divide FH into two equal Parts

Parts in M , and take the Line n , that the *Ratio* of n to FM may be less than the *Ratio* of three times the Square of the Excess of IK above IL to the Sum of the Square of this Excess and of the Square of IL ; then draw the Tangent NO , that OP being let fall perpendicular to FH , NP shall be equal to n . By this means the *Ratio* of NP to FM , and more effectually the *Ratio* of NP to NM , will be less than the *Ratio* of three times the Square of the Excess of IK above IL to the Sum of the Square of this Excess and of the Square of IL ; also by Division the *Ratio* of NP to PM will be less than the *Ratio* of three times the Square of the Excess of IK above IL to the Square of IL ; and likewise the *Ratio* of one third of NP to PM less than the *Ratio* of the Square of the Excess of IK above IL to the Square of IL . Moreover, if OQ be drawn parallel to the Tangent in F , the Triangles OPQ , ILK will be similar; and therefore the *Ratio* of one third of NP to PM less than the *Ratio* of the Square of the Excess of OQ above OP to the Square of OP . But OQ is less than the Arch OF , and therefore the Excess of OQ above OP is less than the Excess of OF above OP . Let PR be taken equal to this latter

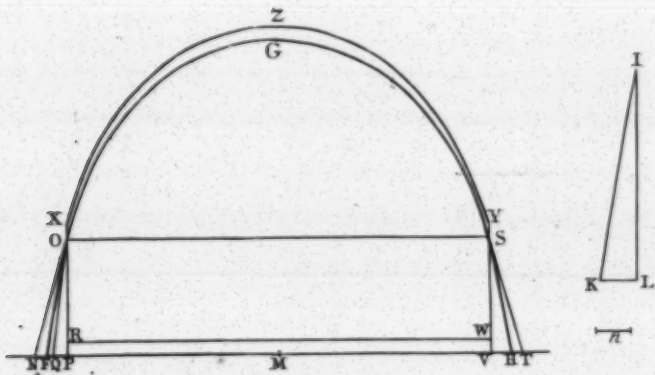


Excess, and then the *Ratio* of one third of NP to PM being less than the *Ratio* of the Square of the Excess of OQ above OP to the Square of OP ; the same *Ratio* of one third of NP to PM shall be yet less than the *Ratio* of the Square of PR to the Square of OP ; and lastly, one third Part of the Solid, whose Base is the Square of OP and Altitude NP shall be less than the Solid, whose Base is the Square of PR and Altitude MP .

Now draw OS parallel to FH , the Tangent ST , the Perpendicular SV , and lastly RW likewise parallel to FH ; then will the Triangles NOP , TSV be similar and equal, and MV equal to MP . Hence the two Cones generated by the Revolution of the Triangles NPO , TVS about the Axes NP , TV will be to the Cylinder generated by the Revolution of the Rectangle $PRWV$ about the Axis PV as one third Part of the Solid, whose Base is the Square of OP and Altitude PN to the Solid, whose Base is the Square of PR and Altitude MP . Wherefore the first of these Solids being less than the latter, these two Cones are less

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less than the Cylinder; and consequently the two Solids generated by the Revolution of the Spaces FPO , HVS about the Axes FP , HV will be still less than the Cylinder produced by the Revolution of the Rectangle $PRWV$ about the Axis PV . But moreover, if PX and VT be taken equal to the Arches FO and SH , so that RX and WT shall be equal to PO and VS ; and if the Curve XZT be described similar and equal to the Arch OGS ; the Space $RXZTW$ is similar and equal to the Space $POGSV$. Therefore since the Cylinder generated by the Rectangle $PRWV$ is greater than the two Solids generated by the Spaces FPO , HVS , the Solid generated by the Revolution of the Space $PXZTV$ about the Axis PV shall be greater than the Solid generated by the Revolution of the Space FGH about the same Axis FH . But the Perimeter of the Space $PXZTV$, excepting the Base PV , is equal in Length to the Curve FGH , and through the Points P and V a Curve may be described of the same Length



that shall produce a Solid yet greater than the Solid produced by the Space $PXZTV$. Therefore the Solid generated by the Curve FGH is by no means the greatest that can be produced from Curves of the same Length with its self applied to the Axis FG .

BUT now since the Curve, which generates the greatest Solid of all, must of Necessity be one of those described by the sixth Proposition, and it is here shewn not to be any of those Curves, whose Tangents in the Points, where the Curve meets the Base, make oblique Angles with that Base, it follows that it must be the Curve, wherein those Tangents are perpendicular to the Base.

PROPOSITION IX.

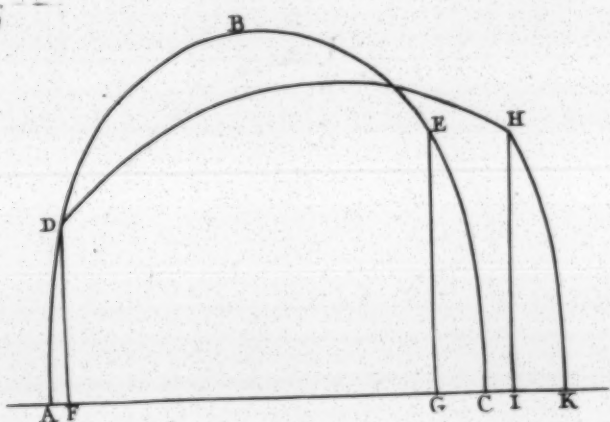
IF in the Curve, which generates the greatest Solid of any of the same Length with its self, any two Points be taken, and from them Perpendiculars be let fall upon

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upon the Base, the Space included by these Perpendiculars and the intermediate Part of the Curve shall generate a greater Solid than can be produced by a Space included under two Perpendiculars of the same Lengths with the former, and under any other Line of the same Length with the intermediate Part of the forementioned Curve.

LET ABC be the Curve, which in revolving round the Axis AC , generates a greater Solid than can be produced in like manner by any other Curve of the



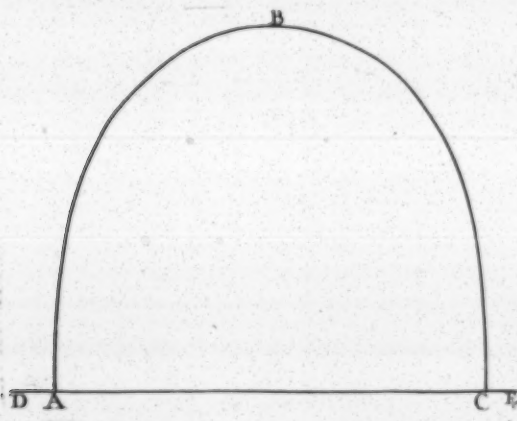
same Length with this. If in this Curve any two Points D, E be taken, and the Perpendiculars DF, EG be drawn, I say the Space $FDBEG$ by revolving round the Axis FG shall generate a greater Solid than any other Space included under two Perpendiculars of the same Length with DF, EG , and under a Line of the same Length with DBE .

If not, let the Space $FDHI$ generate a greater Solid than the Space $FDEG$, the perpendicular IH being equal to GE , and the Curve DH equal to DE . Draw the Arch HK similar and equal to the Arch EC . Then the Solid generated by the Space $FDHI$ being greater than that generated by the Space $FDEG$, the Solid generated by the Space $ADHK$ will be greater than that generated by the Space $ADEC$, which is absurd; for the Curve Line $ADHK$ is equal in Length to the Curve ABC , and the Curve ABC generates a greater Solid than any other Line of the same Length. The Space therefore $FDEG$ generates a greater Solid than any other Space included under Perpendiculars of the same Length with FD, GE , and under any other Line of the same Length with DE .

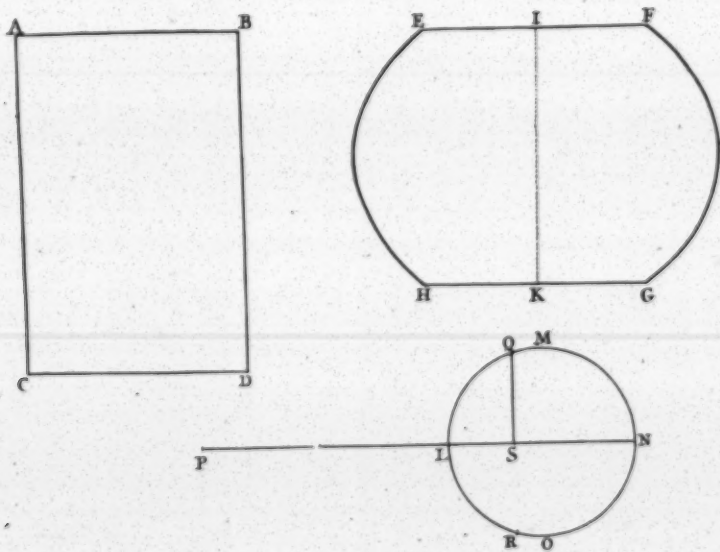
THESE Propositions will afford us the necessary Assistance for making the first Step of the Inquiry, we have proposed, concerning the Supposition, that the muscular Fibres are composed of Vesicles, by whose Inflation those Fibres are contracted. For it will not be difficult now to assign in what proportion the Cavity of the Cells

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on this Hypothesis must be enlarged, in any degree of Contraction the Fibre shall be supposed to undergo. In the usual way of representing these Cells as small Bladders, whose Sides will wholly collapse together, and leave no Vacuity in the Cells, when the Fibre is entirely relaxed; the Fibre may be contracted by the Inflation of these Cells into less than half its greatest Length: For the first Figure of the eighth Proposition represents the Form into which the Sides of such a Cell will be extended, when the Cell is most inflated, as will be evident by comparing what is there demonstrated, with what has been delivered at the Beginning of this second Part *. And in that Figure the Curve *ABC* bears to its Axis *AC* a



Proportion somewhat greater than that of 35 to 16; this Curve *ABC* being equal to the Length of that Cell, when wholly relaxed, whose Length becomes equal to the Axis *AC*, when the Cell is most of all inflated. But let us now suppose the Cell, when uninflated, to be a Cylinder, whose Section through the Axis shall be the rectangular Parallelogram *ABCD*. The Ratio of *AB* the Diameter of the Cell to its Altitude *BD* or *AC* being given, it will be easy to describe the Figure *EFGH*, which shall be similar to the Section through the Axis of this Cell, when



in any degree inflated. Let IK be the Axis of this Figure, or of the Cell, dividing EF and its Equal HG into two equal Parts in I and K . Any Circle $LMNO$ being assumed, and in its Diameter produced the Point P , it is only required to take in this Circle the equal Arches QN , RN of such a Magnitude, that IF and KG being made equal to the Chords of the Arches LQ and LR , and the Curve FG being described from the Circle $LMNO$ after the manner that has been before taught, IF and its Equal KG shall bear to FG the same Ratio as half AB or CD bears to BD or AC : For the Curve EH being described, similar and equal to FG , the Figure $EFGH$ will be similar to the Section through the Axis of the Cell, when in some degree inflated, whose Section when relaxed is the Rectangle $ABCD$. But here we must observe, that when the Point P is so taken, that PL is equal to LN , the Figure $EFGH$ is that, which the Cell will receive, when inflated the most that is possible, and the Proportion of the Side FG to the Axis IK , the greatest that it can ever become by the Inflation of the Cell, as is evident from the two last Propositions; and the more PL exceeds LN , the less will be the Ratio of FG to IK . And this Observation shews, that the Arches NQ , NR , and the Line LP , may be taken of such Magnitudes, that while in the Figure $EFGH$, the Curve FG or EH shall bear the same Ratio to EF or HG as BD or AC bears to AB or CD , the same Curve FG or EH shall likewise bear any assigned Proportion to the Axis IK . As likewise by taking LP equal to LN , the Arches NQ , NR may be taken of such a Magnitude, that the Figure $EFGH$ shall represent the Section through the Axis of a Cell in its greatest Inflation, while the Side FG or EH bears to the Axis IK any given Proportion less than that, which the Curve in the first Figure of the eighth Proposition bears to its Axis. And by this means the Proportion between the Diameter of a Cell and the Length of it may be found, that is required to render the Cell capable of any possible Degree of Contraction.

I NEED not be particular in explaining the way of doing all this, since it is obvious from Sir Isaac Newton's Method of Differences.

BUT now, after the Figure of any Cell has been described, to find the Proportion between the Cavity of such a Cell, when in any degree inflated, to the Cavity of the same Cell when relaxed, which it is our principal design by these Propositions to discover, it is only required farther to know, that QS being let fall perpendicular upon LN , the Solid, made by the Revolution of the Space $IFGK$ about the Axis IK , is equal to a Cone whose Altitude is LN , the Semidiameter of its Base, when PL is equal to LN , containing in power the Rectangle under LN and the Curve FG , together with twice the Rectangle under QS and the mean Proportional between PS and LN ; but if PL exceeds LN , this Semidiameter contains in power, besides the forementioned Rectangles, the Rectangle also contained under half the Excess of PL above LN , and under the difference between the Curve FG and the Axis IK .

By

By Computation upon these Principles it will be found, that if AB or the Diameter of the Cell bears to BD or its Altitude, when uninflated, the Proportion of about 20 to 37, this Cell in its greatest Inflation will be contracted into about two thirds of its greatest Length; and when it is thus inflated, the greatest Diameter thereof will be to the Diameter of its Bases, nearly as 100 to 46; and its Cavity will be enlarged in the Proportion of 24 to 10. If the Diameter of the Cell bear to its Altitude, when relaxed, the Proportion of 20 to 23, the Cell is capable by Contraction of losing one fourth of its Length; and in its most contracted state its greatest Diameter will be to the Diameter of its Bases nearly as 5 to 3, and its Cavity will be enlarged in the proportion of about $16\frac{1}{2}$ to 10. Likewise if the Diameter of a Cell be to its Altitude, when uninflated, as 8 to 5, the Cell can be contracted by its Inflation into four fifths only of its greatest Length; the Proportion of its greatest Diameter in that contracted State to the Diameter of its Bases becoming near the same with the *Ratio* of 100 to 69, and its Cavity will be enlarged in the Proportion of 7 to 5.

MOREOVER it is to be noted, that the Force, with which the Bases of a Cell are made to approach by its Inflation, very much decreases in proportion to the Force wherewith the Cell is inflated, when the Cell approaches its utmost Distention. For this reason it will not be improper to enquire into the Degrees of Enlargement of the Cell in other cases, besides these now mentioned. Of this kind of Computations take the two following Examples. In the first place, suppose the Cell to be so framed, that it shall be capable of contracting to half its greatest Length; for which purpose the Diameter of the Cell must bear to its Altitude, when relaxed about the Proportion of 1 to $10\frac{1}{2}$. In this case, when the Cell is so far inflated as to be reduced into three fourths only of its greatest Length, the greatest Diameter of the Cell shall be somewhat more than seven times the Diameter of its Bases, and its Cavity almost twenty three times enlarged. Suppose again that the Cell by its Inflation can be contracted no farther than into three fourths of its greatest Length: In this case, when it has lost one eighth of its Length only, the Proportion of its greatest Diameter to the Diameter of its Bases will be very little less than the *Ratio* of 3 to 2; and the Cavity of the Cell will be enlarged nearly in the Proportion of $15\frac{1}{2}$ to 10.

By such Computations as these, when it has been discovered in what degree the Cavity of the Fibres of any Muscle is required on the vesicular Hypothesis to be enlarged, in order to render those Fibres capable of the Contraction, that shall be observed to belong to them; the next thing is to consider how much the whole Muscle may be required to increase in Bulk by the Cavities of its Fibres being thus augmented. And this is the first Step towards the Examination of the present Hypothesis; for if the Body of the Muscle is not found to increase in bulk, as much as the Result of these Computations demands, the Hypothesis will appear to be absurd; otherwise

otherwise it will merit further consideration. But in order to make this enquiry into the degree of Intumescence to be expected in the Muscle, some considerations are necessary. In the first place it is very obvious, that the whole Muscle must not be expected to enlarge in its bulk, so much as the Cavity of its Fibres are required to do; by reason that the undistended Part of the Muscle, such as the solid Parts of these Fibres, and the Fat interspersed between them, together with the Blood Vessels and Nerves appertaining to the Muscle, bear without question no inconsiderable proportion to the bulk of the whole Muscle. A caution is likewise necessary in estimating the Degree, in which the Fibres of a Muscle in any Experiment contract; for this must not be determined merely from the Contraction of the whole Muscle, without taking into consideration the Structure of the Muscle, and observing in what manner the Fibres are situated in it. In the third place it should be considered, whether the Muscle experimented upon is contracted to the utmost it is capable of, or not; because in this Hypothesis a greater Intumescence is required to contract a Fibre in any given degree, if that Fibre be capable of a yet greater Contraction, than if the given Degree of Contraction be the utmost Limit of the Fibre's Action. And we ought farther to add, that the Cells of the muscular Fibres cannot receive exactly the Figure, which from the preceding Demonstrations has been attributed to them, unless they were disengaged from each other; whereas by the Resistance, that the Muscle acts against, the Muscular Fibres are compressed together, so that the Figure of their Cells will in a good degree be altered by that Compression, and the Action of each Fibre by that means so much hindered, that a greater Inflation of its Cavity will be required to produce any desired Effect, than if the Fibre were at liberty to act to the greatest advantage. By which means though the Muscle will not take up so much room, as it would do, were its Fibres, when freely inflated, to lie contiguous only to one another, and to leave those intermediate Vacuities, that would be the consequence of their tumified Figure; yet the Bulk of the Muscle must be greater than the collective Magnitude of its Fibres exclusive of those Intervals.

By how much more the Fibres of the Muscle, on which trial shall be made in this Disquisition, are contracted in their Length, by so much more visible and convincing will the Success of the Experiment be. Of all the Muscles in the Body, the Sphincters seem to contract in the most eminent degree; but are out of reach from being experimented upon. In comparison of these, the Muscles of the Limbs, whose Action lies better exposed to Examination, contract but little. Though as they preserve a good degree of Force, even when contracted to the utmost, the Structure of the Joint, they operate upon, will permit; no doubt but they are capable of contracting much more than they do. *Borelli* * indeed undertakes to prove the contrary, that the Muscles by which the Joints are moved are hardly of themselves capable of a greater Contraction than what the Form of the Joints do

* De Mot. Animal. part. I. prop. xi. pag. 25, 26.

allow; and that when the Joints, over which Muscles lie, are fully bent, the Muscles lose all their Force. The latter Part of this Assertion he would prove from observing, that when the Fingers are clinched towards the Palm of the Hand, the Elbow and Wrist being bent, the Palm cannot be pressed with any Degree of Force by the Fingers. But this Observation will no wise confirm what he brings it to prove, seeing the Effect here mentioned may as well be attributed to the Muscles, that are employed in extending the Fingers; which appear to Sense to be overstrained, by the Pain that is felt on the Back of the Hand. And the contrary to this Opinion of his is manifest in the greatest number of the Joints. As to his Observations in dissecting living Animals, to which he appeals for proof, that the Muscles are not of themselves capable of contracting more than he affirms of them; if these Observations were accurately made, they are a considerable Objection against the vesicular Hypothesis, which of necessity requires, that the Muscles should lose almost all their Force, when they approach near the Limit of their Contraction.

To make an exact Judgment how much more the Muscles of the Limbs must in this Hypothesis be supposed capable of contracting, than they do in their ordinary Action, we ought to know the Method of determining, in what Degree the contractile Force of any Vesicle diminishes, in proportion as it is more and more contracted: And this may be determined by the help of the same two Curves, that we made use of in describing the Figures of those Cells. But this I shall not farther prosecute, because no such Augmentation of the Muscle, as is here required, has yet been discovered by any Experiment. On the contrary, the Writers upon this Subject have thought themselves obliged to suppose little or no Augmentation in the Bulk of the Muscle. *Steno* * indeed has argued, and with a greater pomp of Argument than so plain a matter required, that when the Muscle is abbreviated in its Length, it must increase in some other Dimension, in order to preserve its Magnitude; the same thing being also expressly remarked by *Borelli* †. But *Steno* does not incline to admit that the Muscles augment in any Dimension more than is required for this purpose; and so much, no doubt, he thought it necessary to allow of. Though *Borelli* grants that the Muscles of the Limbs, when they act, are rather contracted into a narrower space, than when they lie relaxed ‡. But at the same time, this last Author thinks he has discovered, beyond all question, that the Fibres of a Muscle do increase in bulk, when the Muscle acts. This he would collect from what he imagined he had observed of the Heart: But here he was deceived; for he has without sufficient ground asserted, that when the Fibres of that Muscle contract, and its Cavities are thereby closed up, its outer Surface is not diminished ||. He would conclude the like Intumescence in the Fibres of other Muscles, though the whole Muscle does not increase in bulk, from the consideration only of their growing rigid upon their acting **. But this Argument is not very convincing, if we

* *Myolog. Specim. p. 25.*
prop. 49.

† *Borell. de Mot. Animal. part. II. prop. 14.*
|| *Ibid. prop. 14, & 52.*

** *Ibid. prop. 14.*

‡ *Ibid. ad fin.*

except

except only what room may be made for the augmentation of the Fibres by the Compression the Blood-vessels may be supposed to undergo; which in many Muscles must be very little, where the Magnitude of the Trunks and conspicuous Branches of the Blood-vessels lodged within the Muscle, out of which only the Blood can be pressed in quick Motions of the Muscle, bears a very inconsiderable Proportion to the Bulk of the whole Muscle. Certainly the Induration of the Muscle, from whence he would deduce it, does on no other consideration prove so much: For the Softness and Flaccidity of the Muscle, when out of action, does not necessarily imply, as *Borelli* supposes, that the Fibres lie not then so close together, as when they are in action; but it is sufficient for producing this effect, that the Fibres while relaxed easily yield to any Force, and give place to any thing, that shall press upon them, without their making much resistance; whereas when they are in action and tense, they must resist every Force, that would discompose the Order, in which they lie by one another. But farther it must be considered, that the Bulk of the Muscle ought to be greater, when it acts in a state of great Contraction, than when the Muscle is more extended, though it be in action. And I doubt no Experiment hitherto made gives any ground to suppose this. Whence there is great reason to suspect, that the seeming Intumescence of some Muscles, when they act, does only arise from a Change made in their Figure.

IF this be strictly so, it is evident that the Vesicular Hypothesis must be entirely rejected. And even if we should ever, by any future Experiment, discover the Muscles as they are contracted to augment something in Bulk, I fear this Increase will be so very small, that it will be exceeding difficult to reconcile it to this Vesicular Hypothesis. Although this Difficulty will be somewhat lessened by our first Caution, grounded on the Proportion the contracting Fibres may bear to other accessory Parts of the Muscle. And indeed we have great reason to conclude this Proportion to be but moderate, if we consider how very much the Muscles are diminished in emaciated Bodies, without the total consumption of one muscular Fibre; but only from the loss of the Fat, which the Microscope shews to be every where distributed through the whole Substance of the Muscle.

LET us therefore suppose, that this Enquiry concerning the Augmentation of the Cavity of the contracting Fibres to remain so far doubtful, as to give room for a farther Examination into this Structure of the Fibre. All that *Borelli* * has so tediously and with such Obscurity advanced for the existence of these Vesicles, is at last reduced to that Axiom in Philosophy, that Nature takes the most easy course in all its Productions. For he has not attempted so much to prove his Notions by any Experiments, as to conclude it to be true, because it was the simplest that he was able to frame in his Mind. But such a Method of arguing is very unworthy a

* De Mot. Animal. Part. I. prop. 113, 114. Part. II. prop. 14.

Philosopher; for though we find indeed by manifold Instances, that the Operations of Nature are wonderfully simple and uncompounded; yet we are not to imagine, that the Author of the Universe, in the formation of things, had any such regard to the Weakness of our Capacities, that he should frame his Works in such a manner, as we could most readily comprehend; but that he establish'd such Principles of Action, as might most compendiously produce the infinite number of Operations in Nature, though by what means any one of these Effects can most easily be brought about consistent with the rest, we can in no wise pretend to be proper Judges. In the Example before us, though this vesicular Structure of the Fibres may be the most obvious Method we are able to think of for their Contraction, yet we cannot be certain, but that the Principle that must necessarily be required to inflate and distend them, might possibly be inconsistent with every other Operation in the Animal Oeconomy.

THEY therefore have proceeded with greater Prudence, who have endeavoured to find out something really appearing in the Muscle, that might favour this Opinion. And the first thing that offer'd it self for this purpose, are those slender Filaments which, in rending the muscular Fibres asunder, were found to hold those Fibres together. And certainly if these transverse Filaments connected the Fibres together by being twisted round them, as *Bernoulli* * supposes, they might be thought to divide the Fibres into Vesicles. But this Disposition of these Filaments is not very reconcileable to the anatomical Enquiries that have been made about them. Mr. *Cowper* from particular Observations found them unfit for any such purpose; for they appeared to him no other than small Vessels passing from one Fibre to another. And this Opinion is farther confirmed by the accurate *Morgagni* †, whose Authority is of great weight, as his Discoveries in Anatomy have been highly applauded by the Skilful.

OUR next Enquiry therefore must be, to examine whether this Structure may not be discovered in the still more minute Divisions of the Muscles. For as the Muscles are found to be divided by Membranes running through them into small Parts, and those Parts again subdivided for several Successions; each of which divisions on some accounts may not improperly be considered as a distinct Muscle; so what first offers it self to the naked Eye, under the form of a single Fibre, by the Microscope is found to be a Bundle of Fibres, and as it were a minute Muscle included within a proper Membrane. These lesser Fibres are not too small to be discerned even by the naked Eye, though not without difficulty. But the Microscope shews us farther, that these Fibres are each invested with a Membrane, which includes within it not one simple Body, but a Bundle of still finer Fibres‡. Whether these are likewise compounded of others, has not yet been dis-

* Dissert. Physico-Mech. de Mot. Musc. Sect. II. pag. 3, 4. Edit. Vener. 1721.
tom. II. Animadv. 7.

‡ Leeuwenhoek. Anatom. & Contempl. pag. 46.

† Adversar. Ana-

covered. On the contrary *Leeuwenhoek*, who has pushed his Observations on this Subject farther than any other Person besides, thinks these last mentioned Fibres to be simple hollow Tubes *. But his Observations cannot be wholly relied upon in so subtle a Case; for if those Pores, he sees in the transverse Sections of these Fibres, are really the Interstices between different Fibres, and are too small for his Microscopes to discern the Inequalities of them, they will appear of a round Figure; and consequently as the Hollow of a Tube. Just as the Ring of *Saturn*, before Telescopes were brought to a sufficient Perfection, to discover the less lucid Parts of it, seemed to be two round Bodies placed on each side of that Planet. In the same manner *Leeuwenhoek* himself, in this very Subject, was at first deceived by the Corrugations, as he afterwards found, into which the Membrane, that invests the small Bundles of Fibres before mentioned, forms it self; for seeing these Corrugations indistinctly through less perfect Glasses, he concluded the Fibres to be a String of globular Parts †. But his more exact Observations have not discovered the least Traces of such an Appearance.

THE only Circumstance in all *Leeuwenhoek's* Observations, that any way favours the Hypothesis we are here considering, are those Corrugations he relates the Membrane, that envelops the Fibres, to fall into; which, from the oblique Situation he finds them generally to take, he believes to surround the Fibres in a spiral manner ‡. And indeed were any Substance, firmer than the rest of the Membrane, observed in these Corrugations, it were all that could be wished for in favour of the Hypothesis. If it were so, these Bundles of Fibres might contract themselves by the Intumescence of the Parts between these Corrugations; and the Figure, into which the Sides of these Bundles of Fibres would swell, must be the same as if the Constrictions were directly transverse, as will easily be understood from what *Torricelli* || has writ on the Measurement of the Screw. But no such firm Substance has yet been found in these Corrugations, nor is there any reason to suppose there lies hid in them any such; since the Corrugations in these Membranes have nothing in them peculiar; but the same, without any visible difference, are seen in the Fibres of the Tendons**.

SINCE therefore we cannot make any immediate Discovery of this Structure of the Fibres, we shall even be reduced to the Weakness of *Borelli's* Argument for their Existence, unless we can corroborate his Reason by one of these two Methods; either that we could discover something existing in the Body, that we might know to be capable of inflating these Vesicles, were there any such; or in default of this, that at least we should be able to frame in our Minds a Notion of some Principle suited to produce the Effect required, which we could plainly see, would give no impedi-

* Philosoph. Transact. N^o. 367. pag. 139, 140.
Physiol. Delph. Ann. 1719. epist. 16, 33.
menf. Parab.

† Anatom. & Contempl. pag. 43.

‡ Epist.

|| Oper. Geom. de Cochlea, pag. 136, &c. Tract. de Di-

** Epist. Physiol. epist. 16, 33.

ment to the other Operations in the animal Oeconomy. For without one of these, in acquiescing in this Hypothesis, we shall do no better than that Person, who being only acquainted with the apparent Motion of the Sun, should immediately conclude the Earth to be in the Center of the World, because he could explain what he had observed without difficulty, by supposing the Sun to revolve round the Earth; and should not hold his Mind in suspense, till he had examined the Motions of the other Planets, and considered how well his Opinion could be reconciled to the whole System. As such a Person would act altogether rashly, in imagining the State of things must needs be agreeable to the first Notions of his Mind, and what would appear to him most reasonable, before he had fully inquired into the Constitution of the Universe; so neither ought we to take up an Opinion concerning the Frame of these Fibres, without being able either to see, that they are so framed, or yet to have sufficient reason to know, that muscular Motion could conveniently be produced by such a Structure. For what convinces us, that our first Thoughts of the Motion of the Sun is erroneous, and that the Earth it self really moves, is, that this latter Supposition we cannot only explain with ease the Appearances that belong to the Sun only, but account with the greatest exactness for every Appearance in the whole System. But the Writers on the present Subject have not examined the matter with this exactness; as will appear from the Enquiry we shall now proceed to make into some of the principal Opinions they have advanced.

BUT first it is proper to premise, that the Nerve is one chief Instrument, which puts the Muscle into action, as is evident from hence, that whenever the Nerve belonging to a Muscle is separated from it, it is no longer in the power of the Animal to put the Muscle into action. This Office of the Nerve is generally allowed to be performed by the means of some very fine and subtle Fluid, which is called by Authors the Animal Spirits; and that the Contraction of the Muscles concerned in voluntary Motion arises from this Spirit being some way operated upon at the Original of the Nerves. All which seems evident from this Observation, that a Ligature upon the Nerve deprives the Muscle of its Motion as effectually, as if the Nerve were divided.

PYERUS* indeed has observed of the Heart, a Muscle whose Motion is involuntary, that in some Creatures, as particularly in the Eel and Salmon, by being warmed it would long after the Death of the Animal renew its Pulsation; nay even when separated from the Body. And the same curious Person renewed the Pulsation of the Heart in other Animals also, after their Death, by inflating it through the Receptacle of the Chyle; especially if an external Warmth was likewise applied. But these Experiments are no Objection against the Office assigned to the Nerves in respect of the Muscles concerned in voluntary Motion; for they are consistent with the same Use of the Nerves in the Heart it self, seeing it may

* Miracul. Anatom. pag. 107, &c. in Parergis.

very well be supposed, that the Nerves lodged within the Substance of the Heart may retain a sufficient stock of this subtile Spirit, by which the Muscles are actuated, to produce some degree of Pulsation, when this Spirit shall be put into action, by warming and agitating the Heart; since these Experiments succeeded best in Animals that had died a violent Death, and had not their Spirits exhausted by a long Disease, and a gradual Decay of Life. Nay, as these Experiments do not oppose this Office of the animal Spirits, so we may receive much light from them, not only in relation to the Heart in particular, but concerning the Muscles in general. Of the Heart they seem to inform us, that its successive Contractions and Relaxations do not arise so much from any alternate Change wrought at the original of the Nerves, in the manner that the Muscles, serving for voluntary Motion, are put into action, or caused to rest; but more from the very Structure of the Heart itself, whereby in its contracted state the Passage of the Spirits into its Fibres may be intercepted. For then, without any change wrought in the Spirits at a distance from the Heart, its Fibres cannot remain long contracted; and on the other hand, will be no sooner relaxed, than a Passage being opened for the Spirits into the Fibres, their Contraction will again be renewed. But these Experiments will much assist us likewise in making a right Judgment concerning the use of the Blood in muscular Motion: For the Blood appears some way necessary thereto; since it has been found, that by intercepting the Passage of the Blood to any Muscle, the Muscle loses its moving Power. But from these Experiments it may well be questioned, whether this effect arises from any other Cause, than that by depriving the Muscle of its Blood, the Fibres and Nerves must soon grow cold and stiff: For we see in these Experiments, that the Fibres of the Heart, when warm, contracted themselves, though the Blood was not circulating through them. And this Suspicion, that the Blood assists in muscular Motion only by preserving the Parts in a proper state for the Spirits to pass through the Extremities of the Nerves, and perform their Office on the muscular Fibres, is farther confirmed from Experiments of Mr. Cowper, who by injecting warm Water only into the Artery of Muscles concerned in voluntary Motion, after the Passage of the Blood had been intercepted, caused them to renew their Contraction.

BUT the Authors of the Hypothesis, we intend here to examine, ascribe a more particular Use to the Blood; for they suppose the Fluid in the Nerves to inflate the Cells of the muscular Fibres by rarifying the Blood within them. Without question there are certain Juices intimately distributed throughout these Fibres. Mr. Cowper relates, that he found them very plentifully charged with Mercury he had injected into the Artery. For the explaining of this supposed Operation, our Countryman Dr. Croon*, and Borelli†, proceed no farther than to ascribe it to a Fermentation arising from the mixture of the Animal Spirits with these Juices. But as this general Expression gives us no real light into the Subject, so the

* De ratione Mot. Muscul.

† De Mot. Animal. Part. II. prop. 26, 27.

Effects of this supposed Fermentation shew it must be of a very singular kind, and very different from what generally goes under that Name. That on some occasions this imagined Fermentation should so suddenly be blown up into a great Effervescence, and again so immediately subside, as is required not only for the quickest Motions in larger Animals, but still more surprizingly in the small Insects, many of whose Motions are so prodigious swift, as often to escape the Sight: That on other occasions the same Fermentation should be conducted with such exceeding slowness and regularity, not only in the principal Muscles in action, but in those others, which in almost every Motion of the Body act in subserviency to the principal ones, by preserving themselves in a state of tension, relaxing or contracting by the minutest differences, with infinite variety[†]; that we see the Limbs not only capable of moving with great exactness in the slowest manner, that the naked Eye can discern, but even that Objects shall be carried over the Eye by our Hand with no small degree of slowness, when seen through large magnifying Glasses. No wonder then that, in order to account for these surprizing *Phænomena*, it has been much desired to find out some particular way, by which this so unusual a kind of Fermentation might be explained. For this two Hypotheses have been framed, one by the celebrated *John Bernoulli*^{||}, the other by Dr. *James Keil*^{**}; but both insufficient. They both assume the red Globules of the Blood to be small Bladders filled with Air, or some other elastick matter, in a state of greater compression, than the Air is in, which surrounds the Body. The tenacity of the Coats of these Globules is supposed to retain the elastick Substance within them so compressed; and the taking off that restraint in the Globules, as they pass through the Cells of the Muscles, and thereby permitting the elastic Substance to expand it self, and inflate the Cells, is assigned for the cause of the Contraction of the Muscles. Thus far the two Hypotheses agree; but they differ in the manner of setting the elastic Substance at liberty to expand it self. *Bernoulli* ascribes to the Animal Spirits a pungent and penetrating Quality, by which they might be enabled to perforate the Coats of the Globules, and thereby let out the imprisoned *Aura*. Dr. *Keil* supposes this effect may be produced by the Principle of Attraction, that has been discovered by innumerable Experiments to belong to the small parts of matter^{††}. Upon this Principle it is only required, that the Nerves be so disposed in the Muscles, as to open by numerous Orifices into each Cell, and on every side of it. And when the Spirits are moved toward the Muscle, and are entering into the Cells at those Orifices, as soon as the Particles of them come within a certain distance of the Globules, the Coats of the Globules, and those Particles must be supposed to attract each other. By this Attraction the Particles of the Spirits will have their Motion towards the Globules accelerated; and these Particles, like all corporeal Substances, having a *vis inertiae* in proportion to the quantity of matter in them, they will resist in some degree to this augmentation of their Motion; and so much will the Particles,

[†] See *Memoir. de l'Acad. Royale de Sciences*, Ann. 1720. pag. 87, 88. ^{*} || *Dissert. de Mot. Muscul.* §. 5.
^{**} *Tentam. Medico-Physic.* pag. 135, 136. ^{††} *Newton. Opt.* Qu. 31.

which

which compose the Coats of the Globules, be solicited towards the Particles of the Spirits, and thereby have the force of their Cohesion with each other diminished, giving liberty to the included elastic Fluid to dilate and expand it self. But in this Hypothesis the Globules will expand themselves with no greater force than what could generate in any given space of time that Degree of Motion, which will be communicated by this Attraction to the Particles of the Spirits in the same time; and therefore, considering how very minute the Particles of these Spirits are, this Attraction, to produce any considerable effects, ought to be exceeding strong, and the increase of Velocity given to the Spirits must be immensely great. However, this Hypothesis is better reconcileable than the former to the Quickness, with which the Muscles contract and relax: For the Particles of the Spirits unite with the Globules of Blood in so very short a space of time after their acting upon them, that as soon as a fresh supply of Spirits is discontinued, the Dilatation of the Globules will almost instantaneously cease. But *Bernoulli*, in his Hypothesis, in order to account for this sudden Detumescence of the Muscle, is obliged to represent the elastic matter contained in the Globules so very fine and subtle, and disposed to pass through the Pores of the muscular Cells with so much freedom, as makes it very difficult to conceive, how it should be confined by the tender Coats of the Globules.

BUT yet both these Hypotheses, as I have said before, must be looked upon as insufficient, because the red Globules of Blood, in all probability, are not Vesicles filled with any such elastic Substance, as is supposed in these Hypotheses; but, on the contrary, nothing more than a Fluid, or at least a Substance preserved in a State of Fluidity by the Heat and Motion of it, which will not perfectly mix and unite with the *Serum*; and therefore swims in it under the form of small Globules, for no other reason than Oyl does in Water, when they are agitated together. Which single Observation is sufficient to shew, that neither of these Opinions have that degree of probability, that is necessary to entitle them to a reception. Nay, if the make of these Globules was more doubtful than it really is, yet as these Opinions are no other than mere Hypotheses, we could have no strong persuasion of their truth: especially since these are not the only Conjectures, that might be framed concerning this matter. For might it be allowed to build an Hypothesis on any of the Thoughts of that great Philosopher, whose chief Glory consists in having banished all Uncertainties from his Inquiries into Nature, and in raising natural Knowledge upon a more solid and durable Foundation, we might set the effects of the Animal Spirits upon the Juices, that may be contained in these supposed Cells, in a light yet more familiar, by what *Sir Isaac Newton* * has hinted concerning muscular Motion. For we need not have recourse to any imaginary Elasticity in a Fluid, flowing in the Fibres, if we assume with him, that the Fluid contained in the Nerves is probably no other than part of that subtle, rare, and elastic Spirit, he concludes to be diffused through the Universe, as the most likely

* Newt. Opt. Qu. 24.

Cause of the Reflection, Refraction and Inflection of Light, and of that extraordinary and surprizing *Phænomenon* of Light first discovered by him; of its being subject to regular fits of Reflection and Transmission alternately succeeding each other in its Passage through Bodies *. The same Spirit he supposes to communicate Heat to Bodies †, and to produce all those Appearances, in which the small Particles of Matter seem to attract and repel each other ‡. Allowing, I say, the Fluid of the Nerves to be a Part of this Spirit, the Intumescence of the Juices in the Cells of the muscular Fibres may in some degree be illustrated by a very familiar Operation in Nature, the forementioned Expansion of Bodies by Heat: For if we ascribe this Expansion to the vibratory Motion of the subtle Spirit within the Body, there will nothing more be required for the present purpose, than to say, that the Mind, when it wills a Part to be moved, acts upon this Spirit at the Extremity, to which it is present, of the Nerve, so as to communicate a proper Pulsation and vibratory Motion of this Spirit through the whole Nerve, supposed of so uniform a Substance, that the excited Pulses may be propagated through it without Interruption, till they arrive at the Cells of the muscular Fibres, where they may cause such an Agitation in this same elastic Spirit within the Juices, where-with the Cells are filled, as may rarify and dilate those Juices. Certainly the most suddain Relaxation of the Muscles is easily accounted for by this way of explaining their Motion: For as soon as ever the Mind ceases to act upon that Part of the elastic Spirit, to which it is present, the Pulses propagated from thence will immediately be discontinued; and consequently the muscular Fluid, whose Expansion is occasioned by those Pulses, will forthwith subside; just as the Pulsation of the Air, which is the Cause of Sound, presently stops, and the Sound depending upon it perishes, as soon as ever the sonorous Body ceases to vibrate. Though, as in the Air the different Degrees of Quickness in its Pulsations, by which the several Species of musical Notes are formed, are not the only Varieties in the Air's vibratory Motion, so by the Licence so necessary to the Framers of Hypotheses, we must here conceive some difference between this vibratory Motion, whereby the Fluids in the Muscles are to be expanded, and that which occasions Heat in Bodies; because we do not find the Muscles to grow considerably hot in their Action.

BUT to leave such Guesses, as the Experiments we have mentioned of *Pyerus* and *Mr. Cowper* shew, that the Effects observed from intercepting the Passage of the Blood through the Artery to any Muscle are no direct Proof, that the Blood conspires any farther to muscular Motion, than by preserving the Parts of the Muscle in a due Temper; so by what has now been said, it appears, that we have yet no other convincing Reason to conclude, that the Blood, or other Juices lodged within the Fibres, have any more particular Use therein; as no real Discovery has yet been made of any such Use of these Juices. Nay moreover, since we can neither form any distinct

* *Newton's Opt. Qu.* 18.† *Ibid.*‡ *Philosoph. Nat. Princ.* pag. ult.

Notion of the way the Vesicles of the Fibres should be inflated, nor yet have any direct Proof of the Existence of such Cells; it will at length follow, that the Hypothesis it self can lay claim to no greater Degree of Certainty than any other of those Conjectures, with which *Des Cartes* and his Followers, in contemplating so great a Subject as Nature, have idly amused themselves.

BUT their Method of Philosophy ought entirely to be laid aside: For as the Event has abundantly shewn, that no Improvement in the Knowledge of Nature can thence be expected; so it was the highest Vanity to enter at first upon such a Scheme, seeing to hope any Success therefrom, was to imagine our weak Understandings by a slight Act of Fancy able to penetrate the Designs of the wise Author of all things, of whom it is declared, that his Ways and Thoughts are as far above our Conceptions, as the infinite Extent of the Heavens is remote from this Earth, to which we are confined. We ought not indeed to be easily discouraged from making Inquiries into the Causes of things: For as the Experience of all Ages proves nothing to be more agreeable to contemplative Minds, so nothing seems more worthy of our Thoughts, as the Consideration of the Frame of Nature eminently sets forth not only the Power, but the Wisdom likewise of its Author: And therefore nothing can be more suited to enlarge the human Understanding, and improve the noblest Faculty of our Minds, and at the same time to promote the Knowledge of our Creator, wherein consists our chief Happiness. But the more excellent the Knowledge of Nature is in it self, by so much the more are to be condemned the Proceedings of these mistaken Philosophers. For while the utmost Diligence and Modesty in searching into the Works of Nature by the slowest degrees are of necessity required to enable our limited Capacities to trace out any of the hidden Causes of things, we cannot sufficiently admire, that Men of warm Imaginations should build up at once vain Systems upon rash Determinations of what those Causes are, from ungrounded and precipitate Conjectures. Not as if our utmost Abilities were too small ever fully to discover the Wisdom necessary to compose this Order and Disposition of things, the Authors of this conjectural Philosophy proceed as if they imagined these Effects of infinite Wisdom a Contrivance almost within the reach of human Invention: For however absurd it would be in any one expressly to boast himself endued with Sagacity sufficient to contrive this stupendous Frame of Nature in all its Beauty and Perfections; yet *Des Cartes*, to gain an imaginary Empire in Philosophy, has boldly adventured upon a way, that can be allowed rational only in a Being who thought himself inferior to the supreme Author of all things chiefly in Power.

SURELY nothing but the seeming Impossibility of advancing any great length in natural Discoveries by a more regular Method, could prevail on any sober Inquirers into Truth to follow *Des Cartes* in so preposterous a Course. And indeed we could not much have wondered, if the exceeding small Advancement made in Philosophy
by

by those very few, who through the Course of all the learned Ages, at great Intervals of Time, have distinguished themselves by pursuing their Searches into Nature upon true Principles, had occasioned Philosophers wholly to despair of arriving at any Certainty in the more reclude Parts of Physics. For now our great Philosopher has at length in so surprizing a manner enter'd into the Depths of Nature, we find much less reason to admire, that his Discoveries had lain so long concealed, than that they should ever have been searched out. Discoveries that have given a proof of the most flowing and abounding Invention, of the profoundest Penetration, and of the sublimest Force of Reason: Not only where it was necessary to apply the subtlest Parts of Geometry, and even to improve that Science much beyond its former Bounds; as where he has disclosed the Nature and Operations of Fluids, and discovered the great Principle, that keeps in motion the large Bodies of the Universe; but if possible, yet more in those Advancements he has made from the consideration of Light into a more hidden part of Nature, by the most refined and powerful Reasonings upon the most obvious Observations, even to the deducing many wonderful Secrets of Nature from things, which appeared wholly barren not only to common Capacities, but to the Philosophers of the greatest Penetration.

EVEN fully to perceive the Progress this excellent Person has made in the real Knowledge of Nature, calls for the utmost Application and Thought; insomuch that many, who would have formerly passed for no mean Philosophers, have ingenuously owned themselves unable to comprehend some of Sir *Isaac Newton's* most sublime Speculations. But however difficult the searching into Nature may appear, doubtless when this true Method of Philosophy comes to be generally understood, it will entirely put a stop to the false way, that has prevailed in the World. When we see those Principles of natural Operations, that are now discovered, are so widely distant from our most refined Conjectures concerning them, it will be impossible for us for the future to receive any kind of Hypothesis with the least approbation. If in one of the most simple Productions of Nature, the Motions of the heavenly Bodies, the Principle by which they are preserved, is so much above the reach of our Conceptions, that we hardly find any one, that can reconcile it to his Thoughts, who does not see the full Force of the Demonstrations, by which it is proved; how can we conceive the briskest Imagination ever able to discover any of the more concealed Springs of natural Effects? These Considerations surely will intirely free us from that Mistake the Philosophers seem to have laboured under, who imagined it was required of them to account for almost all the Appearances of Nature; insomuch that we find the very manner how a World or an Animal might be formed, is frequently attempted by the Framers of Hypotheses, who yet were so far from being qualified for so daring an Enterprize, that on the contrary they have shewn themselves not really able to discover the obvious Laws of Motion. But we ought to be more modest in our Inquiries, and not go so precipitantly to work. If we can truly discover any one step, Nature takes in her Productions, we ought to look upon it as a considerable Attainment, without repining at our not being able to trace her
through

INTRODUCTION.

lxxvii

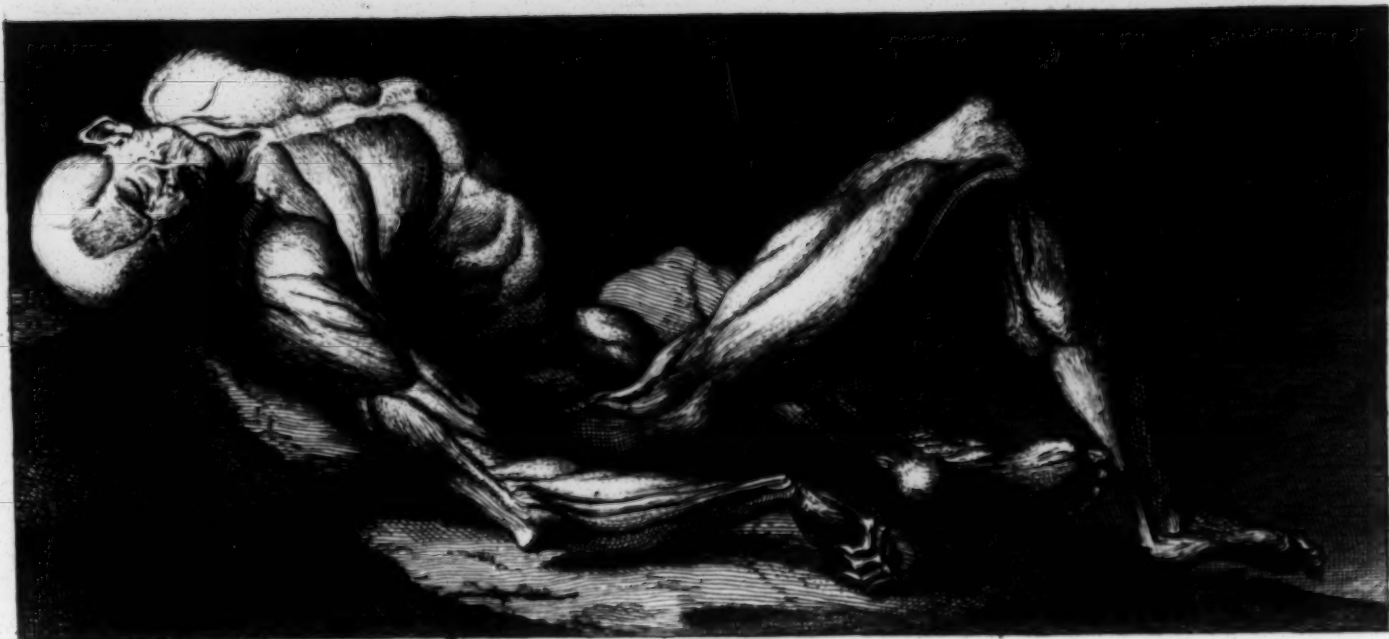
through all her Causes. The least acquaintance with the true Philosophy will serve to shew us, that the Questions generally disputed in the common Systems are so far from being determined, that if we shall ever be able to come at their knowledge, it must be through a Course of many Ages employed in the true Method.

LET therefore the conjectural Philosophy, which has hitherto hindered the Progress, that might have been made in the Knowledge of Nature, be for ever banished. And now a true way is fully brought to light, let every Inquirer after Truth without delay enter upon it. The way indeed is rough, and beset with difficulties, but not unpassable, nor yet unpleasant, if we free our Thoughts from the airy Conceits and exorbitant Expectations, which used to swell the Minds of Philosophers, and make it painful for them to acquiesce in the small Measure of Science within their power. A Mind thus inflated by grasping at the Knowledge of all things, can understand nothing truly; but to one prepared with the just Love of Truth, the Discovery of our Ignorance in any particular will be more grateful than any transient Fame, that may attend a false Pretension to Knowledge. For this reason I have chose in this latter part of the present Discourse only to set out, in the plainest manner I was able, how insufficient all Conjectures have hitherto been at the Cause of muscular Motion, without hazarding to augment the Number of Errors by recommending any new Conceit of my own.

IF I am not mistaken, we must have made a much greater Progress in the Knowledge of Nature, before any Light can be got in so reclusé a Subject with the least degree of Certainty. While we are wholly Strangers to the Principle, that causes the Parts of Matter to adhere together, and how it comes to pass, that this Principle should operate with so much Strength, while the Parts of the solid Body are yet kept from the most intimate Contact they are capable of; how a Body should be increased in all its Dimensions by Heat, and yet retain in great measure its Solidity; how can we know, but there is some Power in Animals, that can operate upon this Principle, which keeps the Parts of their Fibres together, and can strengthen the Effects thereof upon proper Occasions, so that the Particles of those Fibres shall be made to approach each other with great force? And if the Cause of muscular Motion should lie so remote as this Principle, which I see no Absurdity in supposing, it is impossible for us in the present Infancy of natural Philosophy to discover any thing concerning it.

ERRATA.

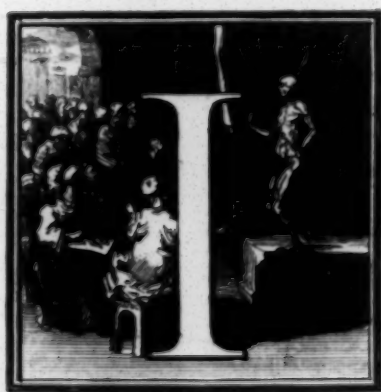
Pag. lxxvii. l. 31. del. *ibat.* Ibid. l. antepenult. l. *Notion.* Passim pro *Gasterocnemius* leg. *Gastrocnemius.*



MYOTOMIA REFORMATA:
OR, A
New Administration and Description
OF THE
MUSCLES
OF A
HUMAN BODY.



CHAP. I.
Of the MUSCLES *of the* ABDOMEN.



It being usual for the Contents of the lower Belly to putrefy and grow offensive sooner than any other Part of the Body, Anatomists for this Reason generally begin their Dissections with the ABDOMEN. This is done by making a crucial Incision through the common Integuments, one Line of which is continued from the *Cartilago Ensiformis* directly to the *Os Pubis*; the other is drawn transversly from the Navel to the Region of the Loins on each side; after which the Skin, Fat, and Membranes of each Portion being raised from their respective Angles, the Muscles

B

of

Of the MUSCLES of the ABDOMEN.

of the ABDOMEN present themselves to View. In the particular Enumeration and Description of these, as well as of all the other Muscles of the Body, we shall constantly observe that Order, in which they will most readily appear in Dissection.

I.

Tab. I. XIV.

OBLIQUUS DESCENDENS,

ARISES partly tendinous, but chiefly fleshy from the lower Margins of the fifth, sixth, seventh, and eighth Ribs, where its several separate Originations lie between the Indentations of the *Serratus Major Anticus*; these, for better Distinction, we chuse to call its first Origin. Besides which, it continues to derive more Heads in like manner from the ninth, tenth, eleventh, and sometimes from the Extremity of the last Rib; which Heads we shall call its second Origin. From the former Origin, its fleshy Part, descending obliquely, expands itself into a broad membranous Tendon, before it marches over the *Rectus* to its Insertion into the *Linea Alba* and *Os Pubis*. From the latter Origin, descending in the same manner, it ends tendinous in the *Os Pubis*, and partly tendinous, but chiefly fleshy, on the upper and forepart of the circular Edge of the *Os Ilium*, without any Adhesion to the *Vertebrae* of the Loins, as *Spigelius**, *Veslingius*†, and with them most other Anatomists, have imagin'd. As its last, thickest, largest, and most fleshy Digitation descends obliquely forward from the lowest Bastard Rib, and recedes more and more from the *Vertebrae* of the Loins, it forms a triangular Interstice, comprehended by its own lower Side, the *Sacrolumbalis*, and part of the Spine of the *Os Ilium*, in which *Area* the Fibres of the subjacent ascending Muscle plainly appear, after raising part of the *Latissimus Dorsi*, and clearing away the Fat.

Tab. XIV. C.
Tab. XV. L. L.

THE lower tendinous Margin of this Muscle, which lies between the Spine of the *Os Ilium* and the *Os Pubis*, is particularly contriv'd to secure the Contents of the lower Belly from being extruded there, in the same manner as it frequently happens at the Perforations for the Passage of the spermatick Vessels. Notwithstanding which, it is not impossible, but that Ruptures may sometimes happen in this Part; and I am apt to imagine this to be the case when a Rupture is very large, and not to be retained by a Truss.

BESIDES the Actions commonly ascribed to this Muscle and its Partner, together with the other Muscles of the *Abdomen*, of assisting in Expiration, of compressing the Intestines, Bladder, and *Uterus*, and thereby excluding the *Feces* and Urine in both Sexes, and the *Fœtus* in Women; they seem to have a farther use in assisting to bend the Body forward: And that Part of them which lies between their latter Origin and the Spine of the *Os Ilium*, may serve for the Circumrotation of the Trunk upon the *Axis* of the *Vertebrae*, when we turn the Body toward the contrary side, the Feet remaining unmoved.

* *Hum. Corp. Fabr. Lib. IV. Cap. x.*

† *Syntagm. Anatom. Cap. II.*

Of the MUSCLES of the ABDOMEN.

3

FOR the better Dissection of the Muscles of the Abdomen, it may be convenient to observe the following Method. First of all raise that Part of the Latissimus Dorsi, which lies on the OBLIQUUS DESCENDENS. This being done, the Blood spong'd up and the Fat clear'd, begin the Separation of the Oblique descending Muscle, by thrusting your Finger between it and the Obliquus Ascendens, at the Extremity of the lowest Bastard Rib: Then raise that Part of the DESCENDENS which springs from the lowest Rib, and terminates in the Spine of the Os Ilium. After which proceed to free the rest of its Digitations from the Serratus Major Anticus, being cautious not to wound its Tendon in dividing it from the subjacent Muscle, especially where it marches over the Rectus. Nor may the Separation of the Tendons of the oblique descending and ascending Muscles be attempted, unless in an Hydropical Subject, by reason of their strict Adhesion to each other. Wherefore in preparing these Muscles, when they are to be shewn after Dissection, you may proceed in the following manner.

THE OBLIQUUS DESCENDENS being raised on either side (as before) to the Rectus, cut through the Tendon of the Ascendens, and raise both Tendons together, taking sufficient Care in their Separation from the Intersections of the Rectus, to which they firmly adhere, and leave them at their Insertion in the Linea Alba. This done, on the contrary side raise the fleshy Part only of the DESCENDENS, beginning in the Linea Semilunaris, by making an Aperture in its Tendon, towards the lower Part of the Linea Semilunaris, where it is separable from the Ascendens: Then thrusting in a Probe between the two Tendons, divide that of the DESCENDENS the length of the Abdomen; after which raise the fleshy Part of the DESCENDENS on this side, clear it to the Extremities of its Digitations, and leave it there. Having thus raised the descending Muscles, that on one side being left at its tendinous Insertion in the Linea Alba, and the other being cleared to its Origination, proceed next to raise the subjacent ascending Muscles, and on that side, where you have before rais'd the DESCENDENS to its Insertion, raise the Ascendens, and leave it at its Origination: On the opposite side raise the Ascendens from its Origination, and leave it at its Insertion in the Linea Alba, continued with part of the Tendon of the DESCENDENS, to which it is inseparably join'd in passing over the Rectus, as above noted.

N. B. You must be cautious in raising the Obliquus Ascendens towards its Origination, lest the Transversalis arise with it; which may be avoided if you begin its Separation in the Ilium, by thrusting your Fingers between the Ascendens and Transversalis.

II.

OBLIQUUS ASCENDENS.

Tab. II. XV.

THIS Muscle arises tendinous from the hinder Part, and fleshy from the fore Part of the Spine of the Os Ilium, and the Ligamentum Pubis, and thence mounting with an Order of Fibres inclining forwards, is inserted fleshy into the eleventh and twelfth Ribs, and afterwards forms a broad thin membranous Tendon, implanted into the whole length of the Linea Alba, and the Cartilages of the eighth, ninth, tenth, eleventh, and twelfth Ribs.

BESIDES

Of the MUSCLES of the ABDOMEN.

BESIDES its use in compressing the Contents of the *Abdomen*, that part of it which arises towards the back part of the Edge of the *Os Ilium*, by the oblique Ascent of its Fibres to the Cartilaginous Endings of the Ribs, not only depresses them and streightens the Cavity of the *Thorax* in Expiration, but in regard the Order of Fibres in this Muscle intersects those of the *Descendens*, these two Muscles must antagonize each other in the Rotation of the Trunk of the Body on the Axis of the *Vertebrae*. In the Structure and reciprocal Co-operation of these Muscles, the ascending on the right side, and the descending on the left, turning the Body to the right; and *vice versa*, the ascending on the left, and descending on the right side; in like manner turning it to the left, the Art of Nature is very admirable, which is particularly taken notice of, and accurately describ'd by * *Archangelus Piccolominus*.

III.

Tab. I. XV.

PYRAMIDALIS *vel* SUCCENTURIATUS.

THIS Muscle lying on the *Rectus*, presents it self next in order of Dissection. It has its Name from its Figure, aptly representing a Pyramid. It arises from the superiour part of the *Os Pubis*, and in its Ascent lessens gradually, till it becomes a long Tendon inserted into the Navel. † *Massa* is the first that (I find) takes notice of these Muscles, but thinks they belong to the *Penis*. ‡ *Riolan* has observ'd the left pyramidal Muscle to be commonly the lesser of the two; and if either be absent, it is usually that. ** *Fallopins* conjectures they compress the Bladder of Urine. *Fabritius ab Aquapendente* imagines they support the *Abdomen*, and hinder the upper Parts from pressing too violently on the inferiour; but this Opinion seems to take its Rise from observing the anatomical Subject in a supine Position. When the Diaphragm is in Action, and the *Viscera* of the *Abdomen* are thereby press'd downwards, the pyramidal Muscles acting at the same time, make a more adequate Compression of the Bladder in the Expulsion of the Urine, than any other Muscle of this Part; though it must be confess'd that all the Abdominal Muscles assist in that Action. They are called SUCCENTURIATI, or auxiliary Muscles, from a Supposition that they are only supplemental to the *Recti*, the Order of Fibres agreeing in both, and these being generally absent when the *Recti* are continued fleshy to the *Ossa Pubis*.

IV.

Tab. I. II.
XVI.

RECTUS,

SO called from the Rectitude of its Position. Anatomists differ in assigning the Origination of this Muscle, some deriving it from the *Sternum*, others from the *Ossa Pubis*; but this seems a matter more of Controversy than Use, since

* *Præleç. Anatom.* p. 74.

† Chap. XXI.

‡ *Anthropolog. lib. v. cap. XXXIV.*

** *Observ. Anatom.*

either

Of the MUSCLES of the ABDOMEN.

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either Part is indifferently mov'd by it, when the opposite remains stable. Little can be added to the common and well known Description of these Muscles, they being continued according to the Length of the lower Belly from the *Cartilago Ensiformis*, two of the Cartilages of the true, and two of the bastard Ribs, down to the *Os Pubis*; and divided into four or five Portions, by three or four transverse tendinous Intersections. The Vessels, which pass underneath the upper Part of this Muscle, are the Mammary Artery descending, and its Vein ascending. Those of its lower Part are the Epigastrick Artery ascending, and its Vein descending. The Inclosure of this Muscle in the double Tendon of the *Ascendens* we could never as yet discern, rather suspecting, that the Adhesion of the Tendon of the *Ascendens* to that of the following Muscle, in the *Linea Semilunaris*, might occasion the Mistake.

V.

TRANSVERSALIS.

Tab. II. v.
xvi.

SO called, because its Fibres run transversely over the *Abdomen*. This Muscle does not arise, according to the common Tradition, from any Ligament, whether springing from the *Os Sacrum*, or covering the *Sacro-lumbus*; but, as *Realdus * Columbus* has it, from the transverse Processes of the Lumbal *Vertebrae*, where it is a thin Tendon, and fleshy from the Spine of the *Os Ilium*, *Ligamentum Pubis*, and the cartilaginous Endings of the Ribs below the *Sternum*, whence its fleshy Part passes over the convex Surface of the *Peritoneum*, and becomes a broad expanded Tendon, before it runs under the *Rectus* to its Implantation into the *Linea Alba*. Sometimes part of the Tendon of the TRANSVERSALIS passes over the inferior Part of the *Rectus*, as appear'd in a Subject I lately dissected, and the upper Part of its Tendon was plainly continued to the *Linea Alba* under the *Rectus*. Perhaps such like Sportings of Nature, may give occasion to those irregular Ruptures, which we sometimes find.

WHEN this Muscle with its Partner act, they press the *Peritoneum* directly inwards, and conspire with the rest of the Muscles of the *Abdomen*, together with the Diaphragm, in compressing the Contents of the Belly. The Tendons of the two oblique Muscles, before they march over the *Rectus* on either Side, being join'd to the Tendon of this Muscle in the *Linea Semilunaris*, do include the *Rectus* in a tendinous Case; which seems no inconsiderable Contrivance of Nature to corroborate the inclosed *Rectus* in its Action. *Caspar † Bartholin* observes in Bulls and other Animals of large Size, that Part of the TRANSVERSALIS is continuous with the Diaphragm at the cartilaginous Endings of the Ribs below the *Sternum*, whence he supposes the Diaphragm to be a trigastrick Muscle. In human Bodies we find, that the Diaphragm and this Muscle are both fix'd to the cartilaginous Endings of the Ribs. The spermatick Vessels pass through this and the ascending Muscle near the *Inguina*, in the mid-way between the fore Part of the Spine of

* *De Re Anatom. lib. 5. cap. 22.*

† *De Structura Diaphragm. cap. 2.*

Of the MUSCLES of the ABDOMEN.

the *Os Ilium*, and the *Os Pubis*; whence descending for some Space between the fleshy Part of the *Obliquus Ascendens*, and the Tendon of the *Descendens*, they run through a Fissure in that Tendon near the *Os Pubis*. Nature has artificially disposed these Perforations not exactly opening against one another, in order to prevent a *Prolapsus* of the Intestines through them. Which Contrivance is not much unlike the oblique Insertion of the *Ureters* and *Ductus Biliaris* passing between the Membranes of the Bladder, and the Intestines, whereby the Return of the Urine in one, and the Bile in the other, is prevented.

BESIDES these Muscles of the *Abdomen*, the Diaphragm may not improperly be reckon'd among them; since without its Co-operation, the abdominal Muscles would not be able to compress the Contents of the lower Belly sufficiently for the Exclusion of the Excrements, &c. But the Diaphragm being a principal Instrument in Respiration, we choose to treat of it among the Muscles of the *Thorax*.

N. B. In the Dissection of the transverse Muscles, Care must be taken not to wound the *Cremaster* on either Side.

WE proceed now to the Muscles of those Parts, which for Conveniency of Dissection offer themselves next, namely, the Testes, Penis, Bladder of Urine, and Anus: In order to which, the Division of the Skin, Fat, and Membranes, must be continued, by a semicircular Section on each Side of the Pubes, meeting in the *Perinæum* near the Anus, after which the Operator must begin to raise the Skin of the upper Part of the Penis, freeing it from the spermatick Vessels, and next raising that Part, which lies in the *Perinæum*. This being done and the Fat remov'd, the following Muscles offer themselves to view.





CHAP. II.

Of the MUSCLES of the TESTES.



ACH Testicle is attended with one proper Muscle call'd *Cremaster*, to which * *Riolan* adds another, and thinks it common to both, comprehending them in the manner of a Bag; but other Anatomists take it for a Membrane only, and call it *Dartos*.

VI.

CREMASTER, or SUSPENSOR TESTICULI.

Tab. xv.
xvii.

IT arises fleshy from the fore Part of the Spine of the *Os Ilium*, its Fibres running parallel with those of the *Obliquus Ascendens*, (not with those of the *Transversalis*, as † *Bartholin* maintains against *Riolan*;) and almost encompassing the Process of the *Peritoneum*, descends to the lower Part of the Process, which incloses the Testicle. Its Name declares its Office.

* *Anthropolog. lib. 5. cap. 36.*

† *Lib. 1. cap. 22.*



CHAP. III. Of the MUSCLES of the PENIS.



Tab. XVII.
XIX.

NATOMISTS generally describe two Pair of Muscles belonging to the *Penis*, viz. *Acceleratores* and *Erectores*. Besides these, we sometimes meet with a third Pair mentioned and figured by *Stephen * Riverius*.

VII.

ACCELERATOR URINÆ.

SO called from its Action, in promoting the Ejection of the Urine and Seed. Authors have been mistaken in assigning the Origination of this Muscle in Men, either to the *Sphincter Ani*, or the Tubercles of the *Offa Ischii*; it arising fleshy from the superiour Part of the *Urethra*, as it passes under the *Offa Pubis*, and encompassing the external Part of the Bulb of its cavernous Body, on which its two Sides meet and join each other in the *Perinaeum*, the whole being one Muscle, and not two. But on that Part of the *Urethra*, from which the *Scrotum* is pendulous, its Sides part again from each other, with two fleshy Elongations, which become thin Tendons at their Insertions on each Side into the *Corpora Cavernosa Penis*, nor do they terminate on the Sides of the *Urethra*, as some Anatomists pretend. But the Variety we meet with of Nature's Sportings in these Muscles, more than in those of other Parts, may perhaps be the occasion, that Authors differ so much in their Accounts of them.

* *Lib. 2. P. 196.*

Of the MUSCLES of the PENIS.

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BESIDES the Use of this Muscle in compressing the *Urethra*, and thereby driving out the Remains of the Urine, and promoting the Ejaculation of the *Semen in Coitu*, (which Action is chiefly performed by the last described Part of it embracing the *Urethra*, as its two Sides, after parting from each other, pass to their Insertions on each Side the cavernous Bodies of the *Penis*) it also assists the following Muscles in the Erection of the *Penis*, by driving the Blood contain'd in the Bulb of the cavernous Body of the *Urethra* towards the *Glans* in greater Quantity, whereby the *Glans* becomes distended. The Veins, which carry back the reflux Blood from the *Corpus Cavernosum Urethrae*, are also at that time compress'd by the Intumescence of this Muscle.

VIII.

ERECTOR PENIS,

Tab. XVII.
XIX.

BY some call'd *Director*, and by * *Spigelius*, *Collateralis Penis*. It arises fleshy from the external Knob of the *Os Ischium*, below the Beginning of the cavernous Body of the *Penis* on each Side, into the thick Membrane of which it is inserted.

WHEN this Pair of Muscles act, they pull the *Penis* towards the *Ossa Pubis*, whereby its great Vein is compress'd, and the reflux Blood stopp'd in its Passage under those Bones, by which means the *Penis* is erected.

IX.

TRANSVERSALIS PENIS.

Tab. XVII.
XIX.

SO called from its Situation. These Muscles are mention'd by *Lindanus* after *Fabricius ab Aquapendente*, as *Thom. Bartholin* takes notice. They arise near the former, from whence they pass transversely to their Insertions, at the upper Part of the Bulb of the cavernous Body of the *Urethra*.

To these may be added the Muscles of the *Clitoris*, and that of the *Pudendum*, in Women.

ANATOMISTS differ concerning the Number of the Muscles belonging to the *Clitoris*; some with *Falloppius* (who first observed them) reckon one Pair only; others two; but *de Graaf* inclines to the first Opinion, which we also think most agreeable to Truth. Authors have not bestow'd any proper Names upon them, but since they agree so exactly with the *Erectores Penis* (above treated of) except only in Magnitude; the same Appellation may likewise serve here.

* *Lib. 4. cap. 12.*

X.

Tab. XVIII.

ERECTOR CLITORIDIS.

THIS arises fleshy from the external Margin of the *Os Ischium*, and is implanted into the Beginning of the cavernous Body of the *Clitoris*.

THE Action and Use of this and its Partner, is the same with that of the *Erectores Penis*. The other Pair of Muscles ascribed to this Part by some Anatomists, and figured by *de Graaf*, are only Portions of the following Muscle, adhering to it.

XI.

Tab. XVIII.

SPHINCTER VAGINÆ.

THIS lies immediately under the *Clitoris*, incompassing the *Vagina* with circular Fibres, three Fingers in breadth. In some Subjects it scarcely appeareth fleshy.

THIS in its Action, not only straitens the *Vagina*, but thereby also stops the Blood in its Return from the *Plexus Retiformis* of the *Pudendum*, by compressing some of its Veins which lie underneath, by which means the *Labia* become distended, and the *Vagina* contracted.





CHAP. IV.

Of the MUSCLES of the BLADDER of Urine.



ALEN * and the ancient Anatomists take notice of but one Muscle belonging to this Part, viz. the *Sphincter*, but *Fabricius ab Aquapendente* mentions another, call'd by *Spigelius*, *Detrusor Urinæ*, from its Use.

XII.

DETRUSOR URINÆ.

Tab. XVIII.

THIS by some is reckon'd the first proper Membrane of the Bladder, lying under that which is continued from the *Peritonæum*. Its carneous Fibres embracing the whole Bladder, compress it in the Evacuation of the Urine.

XIII.

SPHINCTER VESICÆ.

Tab. XVIII.

FALLOPPIUS † observes, that the Anatomists of his time had not well described the Situation of this Muscle, they placing it below the *Prostata*; in which Case, (as he alledges) the *Semen* could not be emitted in Coition, without

* *Lib. de Muscul.*

† *Observ. Anat.*

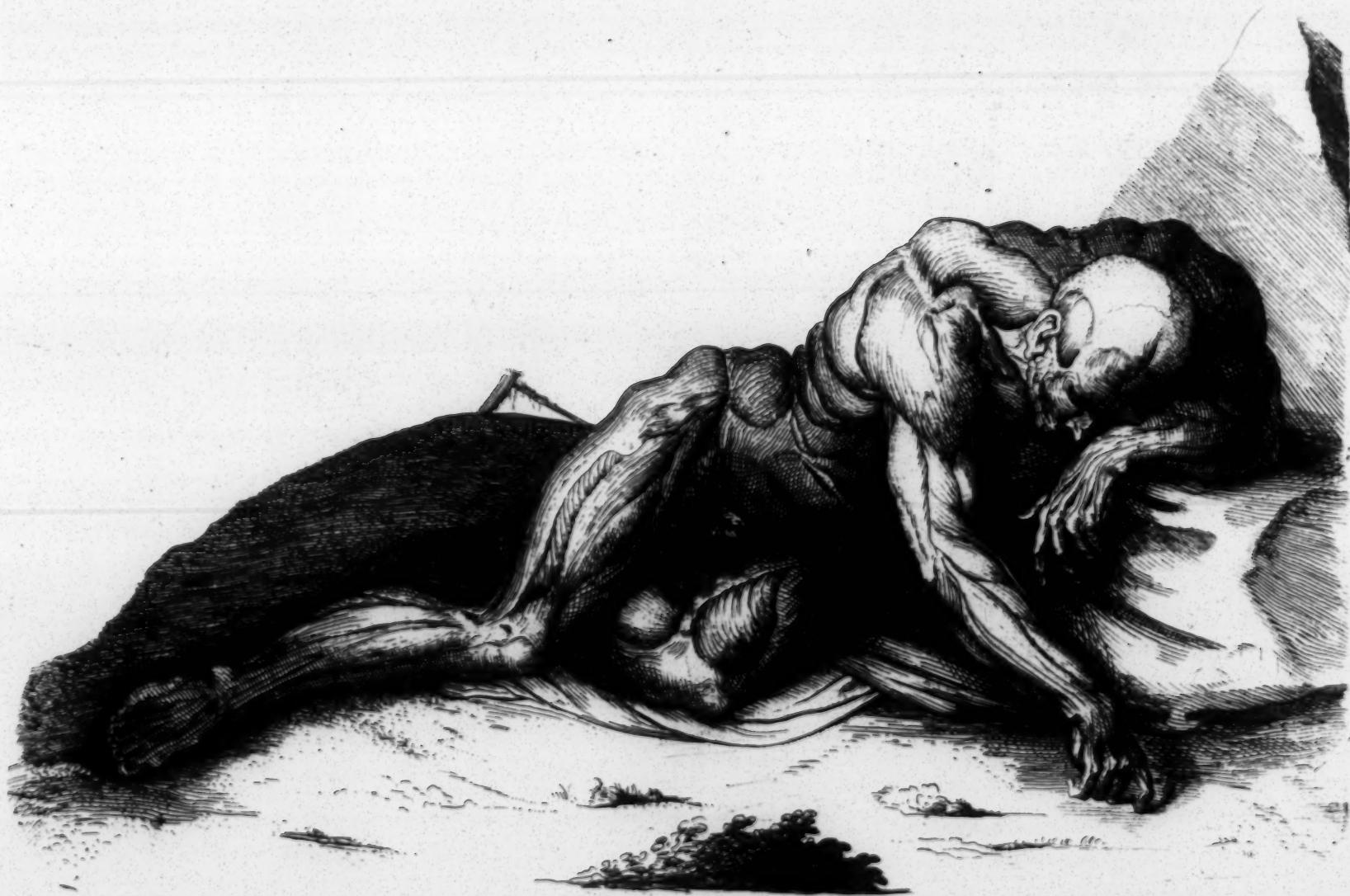
Of the MUSCLES of the BLADDER.

the Urine. Yet it seems his Contemporary *Columbus* * was not unacquainted with its true Appearance. *Natura prudens*, says he, *Musculum tenuem posuit, orbicularem, circularibus Fibris, qui Vescicæ Collum constringit*. This Muscle is seated in that Part of the Neck of the Bladder, which lies immediately under the upper part of the *Glandula Prostatæ*. Where, as *Falloppius* says, † “ You must not expect
“ to find an entire Muscle and Substance distinct from the subject Canal, like that
“ of the *Anus*, but the more fleshy part of the Neck of the Bladder composed of
“ many transverse Fibres, whose Contraction hinders the involuntary Egrefs of the
“ Urine.

N. B. To discover these transverse Fibres, our Author advises to dip the Bladder in scalding Water after Inflation, when the external right Fibres being removed, these will appear underneath. By blowing up the Bladder, and drying it, after the *Prostatæ* were remov'd, we have discover'd the transverse Fibres of the *Sphincter*, as represented in Tab. XVIII. 13.

* *Lib. 5. cap. 26.*

† *Obs. Anatom.*





CHAP. V.

Of the MUSCLES of the ANUS.



ARIOUS Accounts are given us by Anatomists of the Muscles of the *Anus*. *Galen* * divides its *Sphincter* into two, viz. *Carnosus* and *Cutaneus*; which, with the two *Levatores*, make four Muscles belonging to this Part. *Riolan* † multiplies them to the Number of nine, three *Sphincters*, *Carnosus*, *Cutaneus*, and *Vaginalis*; and six Elevators, two internal, and four external, of which one Pair belongs to the *Os Coccygis*. But this Opinion seems rather ground-

ed on Fancy, or some particular Subject, than the general Appearance of them in Dissection.

XIV.

SPHINCTER ANI.

Tab. XIX.
XX.

THIS is a large, thick, fleshy Muscle, encompassing the *Anus*. Its Figure and Series of Fibres externally, immediately under the Skin, incline to a longish Oval. It is connected forwards to the *Accelerator Urinae*, backwards to the *Os Coccygis*. As it is continued farther upon the Body of the *Intestinum Rectum*, its Fibres are circular for near two Inches in Breadth. It is much larger in Man, than in other Animals, in whom, by reason of the erect Position of the

* *De Musculis.*

† *Anthropolog. lib. 5. cap. 40.*

Body, there is greater Force required to retain the *Fæces*, which is the Office of this Muscle.

XV.

LEVATOR ANI.

Tab. XIX.
XX.

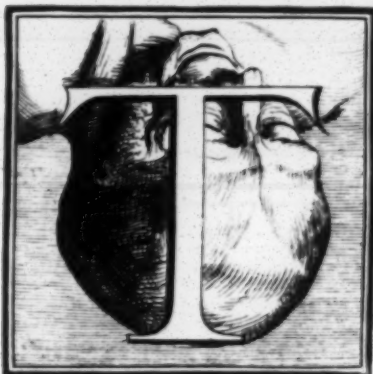
SEEMS to be one Muscle, springing fleshy from each Side the *Offa Pubis*, internally within the *Pelvis*, as also from part of the *Ischium* and *Sacrum*. From these Places, like Lines drawn from a Circumference towards a Center, its Fibres descend over the *Musculi Marsupiales*, to their Implantation at the lower end of the *Intestinum Rectum* in the *Anus*. Besides the Action ascribed to this Muscle, which its Name imports, it has a farther and more remarkable Use, which will appear to any, who examine its Position. For in its Descent on each Side from the *Offa Pubis*, you'll find it passing close over the *Glandula Prostata*; and its back Parts descending from the *Os Ischium* and *Sacrum* must necessarily compress the *Vesicula Seminales*, by drawing up the *Anus* with the lower Part of the *Rectum*, not unlike the Diaphragm in compressing the Contents of the lower Belly. This Muscle therefore, when it acts, will force out the Contents of the *Prostata* and *Vesicula Seminales* into the *Urethra*, the Diaphragm, with the rest of the Abdominal Muscles, making a counter Pressure at the same time, and thereby assisting it to drive out the *Semen in Coitu*.





CHAP. VI.

Of the MUSCLES of the HAIRY-SCALP and FOREHEAD.



To demonstrate these Muscles, make Incision through the common Integuments of the Head, the first and direct Line of Division being continued from the middle and inferiour part of the Os Occipitis, to the same part of the Os Frontis. The other must be made transversely from two Incisions round each Ear, to the Sinciput. Begin to raise the Skin at its Angles, on the Sinciput, taking great care, in freeing the Skin of the Forehead, not to raise the Frontal Muscles.

XVI.

OCCIPITALIS.

Tab. xx.

THIS and its Partner were first discover'd by *Columbus*, and accurately described by *Falloppius**, who took himself to be the first Inventor of them. "In Occipitio, says he, Musculi reperiuntur à reliquis omnibus Anatomicis prætermiffi." They are short, but broad, thin, fleshy Muscles, situate on the *Occiput*, from whence they derive their Names. Each of these arises fleshy from that Part of the *Os Occipitis*, where the *Mastoides* and *Musculus Splenius* are inserted, and soon becoming Tendinous, joins with the *Pericranium*; which firmly ad-

* *Obs. Anatom.*

heres to the Hairy-Scalp on the *Sinciput*. When these act, they pull the Hairy-Scalp backwards; which Action *Columbus* tells us, he had often seen with pleasure in the Head of his Master *Johannes Antonius Plat*, who was wont to move the whole Skin of his Head very freely.

It is certain the Tendons of the Occipital Muscles are continued with the *Frontales*; and, though Anatomists have given them two different Names, the *Occipitalis* and *Frontalis* on each Side are really one Digastrick Muscle, which serves to draw the Hairy-Scalp backwards or forwards, as either fleshy End is contracted. But, because I would avoid Innovation as much as possible, I shall still retain the usual Distinction.

XVII.

FRONTALIS.

Tab. xx.
xxi. xxii.

ITs Rise is already mention'd in describing the Occipital Muscles, besides which it has other Originations, or fix'd Points, to which the Skin of the Forehead is drawn, when its fleshy Fibres are contracted. From these Points arise two several Productions of this Muscle on each Side, the external of which springs from the lower part of the Bone of the Nose near the *Ala*. The other internal, and more fleshy Production, which is broader than the external, lying partly under the *Orbicularis Palpebrarum*, springs from the Margin of the *Os Frontis*, that makes the upper part of the Orbit of the Eye, near the great *Canthus*. This in its oblique Ascent becomes thick and fleshy on the Eyebrow, and afterwards, the two Productions uniting compose that fleshy Body under the Skin of the Forehead. Though these Parts of the Frontal Muscle act separately, whether in lifting up the Eyebrows, and wrinkling the Skin of the Forehead, or in drawing the Eyebrows down, and corrugating the Skin between them, which we call knitting the Brows; yet I see no reason to make them distinct Muscles. That part of it express'd Tab. xxv. Fig. v. at *b*, was first taken notice of by *Vocherus Coster*, and has been since call'd *Corrugator*.

Tab. xx. a;
b, and
Tab. xxv.
Fig. v. a,
b.

N. B. To raise the Skin, and discover the Muscles of the Face, which in the Order of Dissection are next to be prosecuted, continue your former Division from the Dorsum Nasi, where you left it, to its Apex; and from two Semicircular Sections, one on each Side the *Alæ Nasi* to the Septum Narium, make a direct one to join with a Circular Incision round the Lips. Then from the middle of the lower Lip, draw your Knife directly over the Chin, Neck, and Sternum, till you meet that longitudinal one made in Dissection of the Muscles of the Abdomen. The Skin is best cleared from the Eyelids, after raising it from the circumjacent Parts. In this Operation special Attention must be had, lest you wound the *Orbicularis Palpebrarum*, and Muscles of the *Alæ Nasi*. Care also must be taken in raising the Skin of the Neck, and Face, not to raise the *Quadrati Genarum* along with it.



CHAP. VII.

Of the MUSCLES of the CHEEKS and LIPS.



THE Descriptions and Uses of these Muscles given by Anatomists, are so various, that to recite their several Accounts of them would be exceedingly tedious to the Reader, and at the same time of very little Use. For which reason I shall only represent them, as they have appear'd to my self in some late Subjects.

THE Muscles of the Lips are either *Common* to the Cheeks and Lips, or to both Lips, or *Proper* to the upper, or under Lip only.

THOSE *Common* to the Cheeks and Lips, are two Pair, on each Side two Muscles, viz. the *Quadratus* and *Buccinator*.

XVIII.

QUADRATUS GENÆ, or QUADRATUS COLLI, Tab. I. XXI. *by some call'd Tetragonus, and by Galen, Platysma Myoides.*

AS a thin Membranous Beginning, according to *Galen* *, from the Spines of the *Vertebrae* of the Neck, and from the Skin on the *Cucullaris* and Pectoral Muscle; whence ascending with an oblique Course of fleshy Fibres, on the Side

* *De Musculis.*

of the Neck, it is fastened to the *Processus Mastoideus* and root of the Ear; after which it passes over the lower Side of the inferior Jaw-bone, the Parotid Gland, and *Masseter* Muscle, and is at length inserted into the Cheek, the Angle of the Mouth or Lips, and the middle of the lower Jaw-bone, where its Fibres in some Subjects decussate those of the other Side.

WHEN both these Muscles act, they pull down each Angle of the Lips, together with the Cheeks, and part of them may assist the Digastrick Muscles in opening the Mouth.

XIX.

BUCCINATOR.

Tab. XXI.
XXII. XXIV.

THIS Muscle does not spring from the Gums of the upper, and end in those of the lower Jaw; nor is it of that Figure, which some Anatomists would persuade us, or interwoven with various Orders of Fibres, as others pretend. It arises broad and fleshy from the fore-part of the *Processus Corone* of the lower Jaw-bone, from whence it proceeds with direct Fibres to its Insertion at the Angle of the Lips. Through the middle of this Muscle passes the *Ductus Salivaris superior*, which was observ'd by *Placentinus*, and by him call'd *Vinculum Robustum*.

BESIDES the Use, which Trumpeters make of these Muscles acting together, either of them contracting alone pulls the Lips to one Side.

THE Muscles common to both Lips are such as are inserted into their Angles, as the *Zygomaticus*, *Elevator*, *Depressor*, and *Constrictor Labiorum*.

XX.

ZYGOMATICUS.

Tab. XXI.
XXII. XXIII.

SO called, because it arises from the *Os Jugale*, or *Zygoma*. Its Origination is round and fleshy from the external part of that Bone, whence descending obliquely forwards, it is inserted near the Angle of the Lips. In some Subjects I have found it divided at its Termination.

WHEN this Muscle and its Partner act together, they draw both Lips upward; but if one of them acts alone, it distorts the Mouth, whence it is by some called *Distortor Oris*.

XXI.

ELEVATOR LABIORUM.

Tab. XXI.
XXII.

THIS lies between the former Muscle and the *Elevator Labii Superioris Proprius*. It arises from the fourth Bone of the upper Jaw, and descends directly to its Insertion under the Termination of the former Muscle.

XXII.

DEPRESSOR LABIORUM.

Tab. XXI.
XXII. XXIII.

THIS arises fleshy from the lower edge of the inferiour Jaw-Bone laterally, whence it ascends to its Insertion at the Angle of the Lips.

THIS draws down the Corner of the Lips.

XXIII.

ORBICULARIS LABIORUM.

Tab. XXI.
XXII.

THIS environs the Lips with Circular Fibres, and is called *Constrictor*, or *Sphincter Labiorum*, as likewise *Osculatorius*, from its Use.

THE Muscles Proper to the upper, or under Lip, are three Pair, viz. *Elevatores Labii Superioris Proprii*, *Depressores*, and *Elevatores Labii Inferioris Proprii*.

XXIV.

ELEVATOR LABII SUPERIORIS PROPRIUS.

Tab. XXI.
XXII.

THIS arises fleshy from the fore part of the fourth Bone of the upper Jaw, immediately above the *Elevator* treated of before, and descends obliquely under the Skin of the upper Lip, joining with its Partner in a middle Line, from the *Septum Narium* to its Termination in the *Sphincter Labiorum*. It has a double Series of Fibres. The external descend obliquely from its Origine, and are very thin. The internal decussate the former at Acute Angles, and pass in an arched manner under the *Alæ Nasi*, seeming to be a continuation of the *Orbicularis Labiorum*. The external Series give Slips of fleshy Fibres to the two Cartilages of the *Alæ Nasi* at their meeting with the *Septum*. These make the Furrow in the middle of the upper Lip, under the *Septum Narium*.

XXV.

DEPRESSOR LABII INFERIORIS PROPRIUS.

Tab. XXI.
XXII. XXXI.

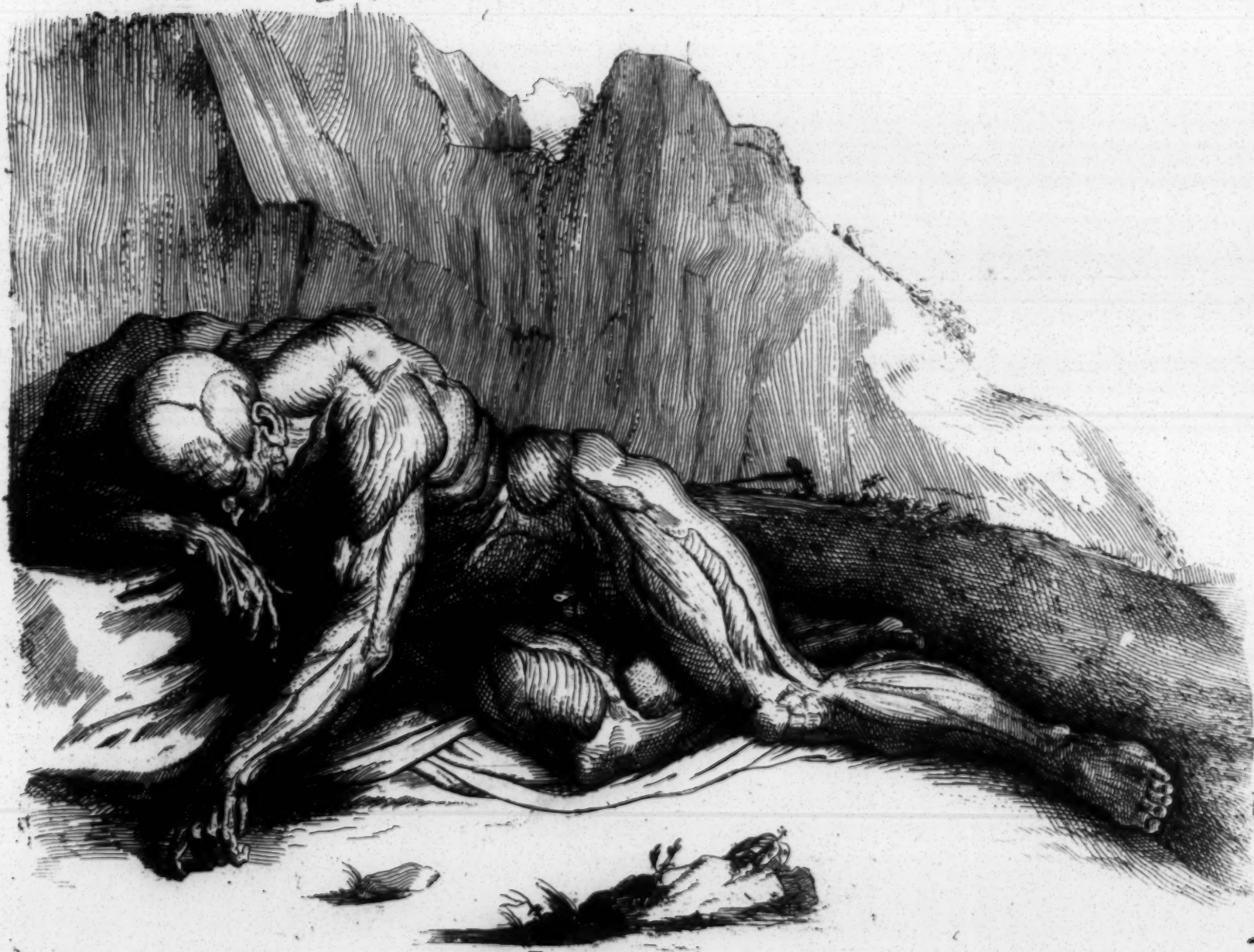
ITs difficult to determine, whether this be one, or two Muscles. It lies between the *Depressores Labiorum Communes*, described above, possessing that part of the lower Jaw called the Chin, and ascending with a twofold order of Fibres, one direct, and the other transverse, is inserted into the lower Lip; in depressing which, it turns it outwards.

. XXVI.

Tab. XXXI.

ELEVATOR LABII INFERIORIS PROPRIUS.

THIS Muscle with its Partner lies within the lower Lip, and was first observed by us some time since. It arises fleshy from the fore part of the lower Jaw-Bone, below the Gums of the *Dentes Incisivi*, and descends directly to its Insertion into the inferiour part of the Skin of the Chin. When these Muscles act, they make divers Indentations in the Skin of the Chin, as may be observ'd in living Subjects, when the lower Lip is drawn upwards.





CHAP. VIII.

Of the MUSCLES of the EYE-LIDS.



ALLEN* and the ancient Anatomists, together with Vesalius† and some later Writers, are extremely deceived in their Notion of these Muscles, in dividing the *Orbicularis* into two, and supposing thereby all the Motions of the Eye-Lids to be perform'd. But this System was first alter'd by Falloppius**, partly from an Intimation of Oribasius in his Book *De Diffect. Muscul. ex Galeno*, Cap. VI. where he takes Notice, that in the Cure of an *Ægilops*, not only

the described Beginnings of the Orbicular Muscles are cut and burnt away, but the Bone underneath exfoliated, and yet the Motions of the Eye-Lids remain; and partly from the Dissection of the Eye in a Sea-Calf, where he observed four Muscles latent in the Orbit, inserted above, underneath, and on both Sides the *Palpebrae*. Being induced upon this to make the like Inquiry in a human Body, he happily discover'd the *Aperiens Palpebram Rectus*, which shall be described hereafter. We mention this Passage, because some later Authors have favoured the erroneous Account of the former Anatomists, retaining their Description of the *Orbicularis Palpebrarum*, and dividing it into two Semicircular Muscles.

XXVII.

ORBICULARIS PALPEBRARUM.

Tab. XXI.
XXII. XXV.
Fig. 1.

THIS is a thin fleshy Muscle, whose Fibres do circularly environ the Eye-Lids, and are inserted into them, (like the *Sphincter Labiorum*) not adhering to any Bone, from whence we may derive their Origine, except the superiour part of the great Bone of the Nose; by some reckoned the fourth Bone of the upper Jaw.

THIS Muscle, acting like the Sphincters of other Parts, constricts the Eye-Lids. To these Riolan‡ adds another Muscle belonging to each Eye-Lid, which

* *De Diffessione Muscul.*
‡ *Antropog. lib. 5. cap. 10.*

† *Hum. Corp. Fabric. lib. 2. cap. 10.*

** *Observ. Anatom.*

Of the MUSCLES of the EYE-LIDS.

he calls *Ciliaris*, which we take to be a Portion of the former adjacent to the *Cilia*.

To discover the following Muscle, part of the former lying between the upper Eye-Lid and Eye-brow, must be raised: After which, the Glandula Lachrymalis, with part of the Fat within the Orbit being removed, by extending the upper Eye-Lid, either with a Hook, or your Fingers only, its tendinous Insertion and fleshy Body will appear.

XXVIII.

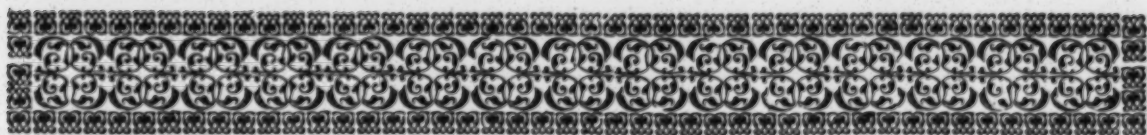
APERIENS PALPEBRAM RECTUS.

Tab. XXV.
Fig. 1.

SO called from its streight Progress and Use. It arises sharp and fleshy from the profoundest part of the *Orbit*, near the place where the Optick Nerve is transmitted; and passing directly over the *Musculus Attollens*, it becomes tendinous, as it marches over the Bulb of the Eye; where growing still broader and thinner, it is inserted into the whole superiour part of the upper Eye-Lid.

THESE Muscles of the Eye-Lids being removed, we proceed next to those of the Eye itself, in the Demonstration of which, Fabricius ab Aquapendente * proposes two ways; the one shewing the Eye with its Muscles in situ, the other the Eye taken out of its Cavity, and its Muscles expanded on the Table: The first exhibiting their Motions, the second their Figure or Shape. In the first, though our Author advises the Brain to be taken out, and the Bones of the Orbit to be divided; yet we chuse to perform this Operation in the following manner, without troubling our selves with either. Both Eye-Lids being removed, first with your fore Finger feel gently for the Trochlea, situated near the brink of the Orbit, towards the Nose; then clear the Tendon which passes through it. This done, in like manner clear the opposite Muscle, the Obliquus Inferior, first observing its Origination at the brink of the inferiour part of the Orbit; then with the Assistance of a small Hook and Scissars extract the Fat, Membranes, and Vessels; from between the streight Muscles. The other manner of Demonstration may be practised in the same Eye, or the opposite, taking care in freeing the Trochlea from the Orbit, to avoid wounding the Tendon, which passes through it. The inferiour oblique Muscle being cut off close from its Origine, as also the rest of the Muscles, and the Optick Nerve at the profoundest part of the Orbit, and the whole Eye being dislodg'd; disengage its Muscles, and display them, whereby you may observe, that the Trochlearis is the longest Muscle of the Eye; and that its Insertion is directly behind the Attollens; and on the contrary, that the Obliquus Inferior is the shortest, whose Termination is directly behind the Abducens, by which means you may distinguish the right Eye from the left.

* De Visione. Cap. 11.



CHAP. IX.

Of the MUSCLES of the EYE.



OLUMBUS * reprehends Galen, Vesalius, and the Anatomists of this Time, for ascribing the *Aperiens Palpebram Rectus* and *Obliquus Superior* to the Eye, and at the same time commits no less an Error himself, not only in supposing, that the last named Muscle belongs to the Eye-Lid, but likewise in imagining, that the *Obliquus Inferior* begins and ends in the *Cornea* of the Eye. But the accurate Fallopius †, who first observed the *Trochlea*, has

given us the most exact Description of these Muscles of the Eye, as well as those of the *Palpebrae*.

XXIX.

OBLIQUUS SUPERIOR or TROCHLEARIS.

Tab. xxv.
Fig. I. II.
III. IV.

IT receives its first Denomination from its oblique Position and Course, in regard of the rest of its Fellows. The second it derives from that Cartilaginous Ring, placed near the Brink of the upper Part of the *Orbit* towards the Nose, through which its Tendon passes, being reflected on it, as a Rope on a Pulley. Besides which, it is called *Longissimus Oculi*, as exceeding the others in length. It arises sharp and fleshy from the profoundest Part of the *Orbit*, near the Origination of the *Adducens*, and becoming a fleshy Belly, as it passes obliquely close under the superiour Part of the Bone of the *Orbit*, it makes a round Tendon running through the *Trochlea* (as above mentioned;) from whence reverting back, it's inserted into the *Tunica Sclerotis*, in the mid way between the Termination of the *Attollens* and Optick Nerve, towards the back Part of the Bulb of the Eye.

* *De re Anatom. lib. 5. cap. 8.*

† *Obs. Anatom.*

XXX.

OBLIQUUS INFERIOR.

Tab. XXV.
Fig. 1. II.
III. IV.

Also called *Brevissimus Oculi*, it being the shortest Muscle of the Eye. This springs sharp and fleshy from immediately within the lower, and almost outward Part of the *Orbit*, at the Juncture of the first Bone of the upper Jaw with the fourth, and becoming thicker, ascends obliquely over the *Deprimens*, growing tendinous at its Insertion into the *Tunica Sclerotis*, near the Implantation of the former, directly betwixt the *Abducens* and Optick Nerve.

THE two oblique Muscles are by some called *Circumagentes*, and *Amatorii*, from their Actions in winding and rolling the Eye about, which Motions we call Ogling. Anatomists differ in assigning the proper Offices of these Muscles, some asserting when the Superiour acts, the Eye is rolled from the Nose; when the Inferiour, to it. Others, on the contrary, suppose that the former draws it to the Nose, and the latter directs it towards the lesser *Canthus* of the Eye. But if we rightly consider the Position of the *Trochlea*, which determines the Motion made by the Superiour Oblique Muscle, and the Origination of the Inferiour; and that the Tendon of the former, and the whole *Ductus* of the latter, pass obliquely from the external edge of the *Orbit* to their Insertions at the back part of the Bulb of the Eye; we must necessarily conceive, that the vulgar Doctrines of their Motions are erroneous. For when the *Obliquus Superior* acts, the posteriour part of the Bulb of the Eye must approach towards the *Trochlea*, whereby its Globe is not only drawn somewhat forwards, but its *Pupil* is directed downwards; so on the contrary, when the *Obliquus Inferior* acts, the posteriour part of the Bulb of the Eye approaches towards the external edge of the inferiour part of the *Orbit*; its *Pupil* is directed upwards, and its whole Globe is pulled somewhat outwards. Hence it is that the Bulb of the Eye is more protuberant in those Actions; which Contrivance in Nature seems very necessary, since otherwise the Projections of the Eye-brows and Cheeks would be liable to hinder our Prospect, whether directly upwards or downwards. Besides the Uses of these oblique Muscles now mentioned, they have still a more notable one, not only in pulling the whole Eye directly forwards, but in holding it from being retracted, when any of the four streight Muscles act, which otherwise would rather draw it inwards, then turn it either sideways, or upwards, or downwards. But these Muscles, one of them descending inwardly from the uppermost, and the other ascending from the lowermost edge of the *Orbit* to their Insertions, prevent its being drawn back into the *Orbit*, and serve as an Axis for the Motions of the other Muscles. Hence it is, when they cease to act, the whole Globe of the Eye sinks, which may give occasion for that vulgar Tradition, that the Eye-strings break in dying Persons.

THE rest of the Muscles of the Eye are called *Recti*, from their streight Progress and Use.

XXXI.
ELEVATOR OCULI.

Ibid.

IS also called *Superbus* from its moral Signification, it being one of the common Marks of a haughty Disposition to toss up the Eye; wherefore its opposite Muscle is called *Humilis*; but *Placentinus** thinks the Motions of the upper Eye-lids denote those Dispositions more significantly; for says he, *Qui enim hanc elatam habent*, (speaking of the upper Eye-lid) *Superbi & Feroces sunt; qui vero depressam ac dimidium fere Oculum Claudentem, ita ut Terram adspicere videantur, Humiles ac Mites sunt.* This Muscle arises sharp, and fleshy, near the place where the Optick Nerve enters the Orbit, and becoming a fleshy Belly, makes a thin Tendon inserted into the *Tunica Sclerotis*, on the Superiour and Fore-part of the Bulb of the Eye under the *Adnata*.

XXXII.
DEPRESSOR OCULI.

Ibid.

THIS, like the former, arises from the profoundest Part of the Orbit, and like it passes directly to its Insertion into the opposite part of the Globe of the Eye.

XXXIII.
ADDUCTOR OCULI.

Ibid.

SO called because it draws the *Pupil* towards the Nose, and *Bibitorius*, from directing the Eye towards the Cup. The Origine and Progress of this is agreeable to the two former, but it is inserted into that part of the *Tunica Sclerotis*, which borders on the Nose.

XXXIV.
ABDUCTOR OCULI.

Ibid.

SO called from its Action in drawing the Eye from the Nose; it is also called *Indignabundus*, because it is made use of to express Scorn and Resentment. This, like the three former, arises near the Entrance of the Optick Nerve into the Orbit, and is inserted like them into that part of the *Tunica Sclerotis*, that respects the lesser *Canthus* of the Eye, opposite to the Implantation of the former. When these four right Muscles act together, they pull the whole Globe of the Eye into the Orbit, from whence it's pull'd forwards again by the two *Obliqui* as before.

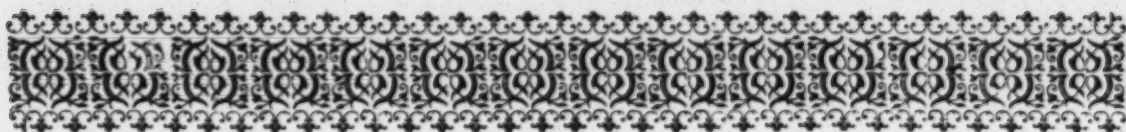
* *Casseri*, lib. 5. cap. 18.

Of the MUSCLES of the EYE.

To these *Mullinete* adds * another, which he calls the Fifth Right Muscle; the Office of which he confines to the Motion of the *Trochlea*, (supposing it moveable;) but what he has said concerning it, either as to its Existence, or Use, is so obscure, if not impossible, that there is no Reason to give it any Place or Description amongst the other Muscles of the Eye. Neither could we ever discover by Dissection any such Muscle, but suspect that part of the *Orbicularis Palpebrarum*, which adheres to the *Trochlea*, might occasion the Mistake. Which I rather remark, because I find others upon *Mullinete's* Authority, without strict Enquiry into the Matter, have fallen into the same Error.

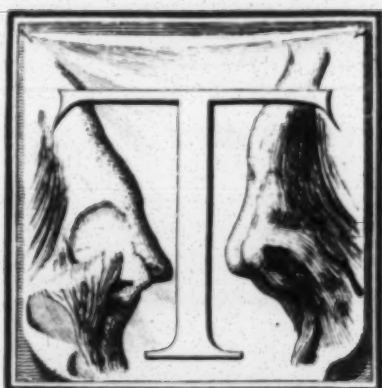
* *Dissertat. Anatom. cap. 6.*





CHAP. X.

Of the MUSCLES of the NOSE.



THE Nose is altogether immoveable, except in its lower gristly Part, the Sides of which are not improperly called *Alæ* or *Pinnae*, by whose Approach, or Recess, the Nostrils are straitned, or dilated. *Galen* * assigns but one Pair of Muscles to the *Alæ*, to which *Jacobus Berengarius Carpenfis* in his Commentary on *Mindinus* adds another, arising from the Extremities of the Bones of the Nose, and inserted into the inside of the *Alæ*; wherein he is followed

by *Vesalius* †. *Columbus* ‡ says, those described by *Galen* belong to the upper Lip, and that those placed in the inside of the Nose (above-mention'd) are entirely fictitious; describing still another Pair, arising from the upper part of the Bones of the Nose, and inserted into their *Alæ*. *Falloppius* ** is not positive, whether he has seen those internal Muscles mention'd by *Berengarius* and *Vesalius* or no; but he describes another Muscle, which later Anatomists call *Constrictor Alæ Nasi*; the Invention of which is claim'd by *Casseri* *Placentinus* ††. I find in general, that Nature is more inconstant in these Muscles, than in those of any other Part; but the following Account is taken from their most common and usual Appearance.

XXXV.

ELEVATOR ALÆ NASI.

Tab. XXI.
G, g.
Tab. XXII.
XXV.
Fig. v. vi.

THIS seems to be an Elongation of the Frontal Muscle, continued from the upper part of the Bone of the Nose, and descending obliquely to the *Ala Nasi*, where it partly joins with the following, and partly passes over, or sometimes under it, to its Insertion in the *Ala* and upper Lip.

* *De Diff. Musc.*
** *Obs. Anatom.*

† *Lib. 2. Cap. 13.*
†† *Lib. 3. Cap. 9.*

‡ *De re Anatom. lib. 5. cap. 4.*

XXXVI.

Tab. XXV.
Fig. V. VI. DILATATOR ALÆ NASI, & ELEVATOR LABII
SUPERIORIS.

THIS Muscle was mention'd by *Galen*. It arises thin, broad, and fleshy, from the fourth Bone of the upper Jaw; whence descending with a two-fold Order of Fibres, it is inserted into the upper Lip and *Ala Nasi*.

XXXVII.

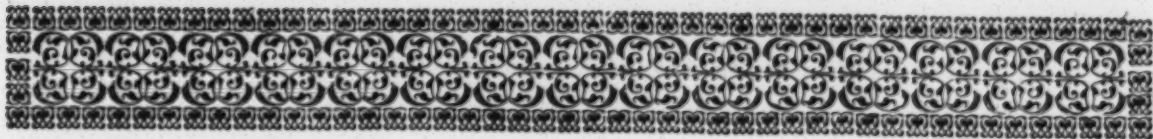
Tab. XXV.
Fig. VI.

CONSTRUCTOR ALÆ NASI.

THIS arises fleshy from the fore part of the fourth Bone of the upper Jaw, immediately above the Gums of the *Dentes Incisarii*; and ascending, is soon inserted into the Root of the *Ala Nasi*.

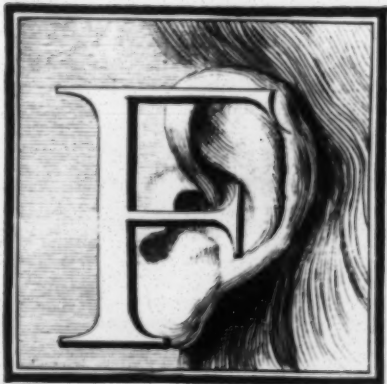
WHEN these Muscles act, they draw the *Alæ* downwards and nearer each other.





CHAP. XI.

Of the MUSCLES of the AURICULA or OUTWARD EAR.



ALLOPPIUS*, the first Writer of these Muscles, informs us there are sometimes found three belonging to each Auricle; the First or *Attollens*, the Second or *Deprimens*, and the Third, which is part of the *Platysma Myoides*. These, he says, are sometimes wanting, though he has frequently seen them. *Placentinus*† multiplies them to the number of Five; but M. *Du Verney*, in his accurate Treatise of the Ear, describes two only, whose

Account we have found to be most agreeable to our own Enquiries.

XXXVIII.

ATTOLLENS AURICULAM.

Tab. xxv.
Fig. vii.

THIS consists of divers fleshy Fibres, and is annex'd to that part of the *Perricranium* that covers the temporal Muscle, whence it descends directly to its Implantation at the superiour part of the second Wrinkle of the Cartilage of the Ear.

Its Name declares its Use.

XXXIX.

RETRAHENS AURICULAM.

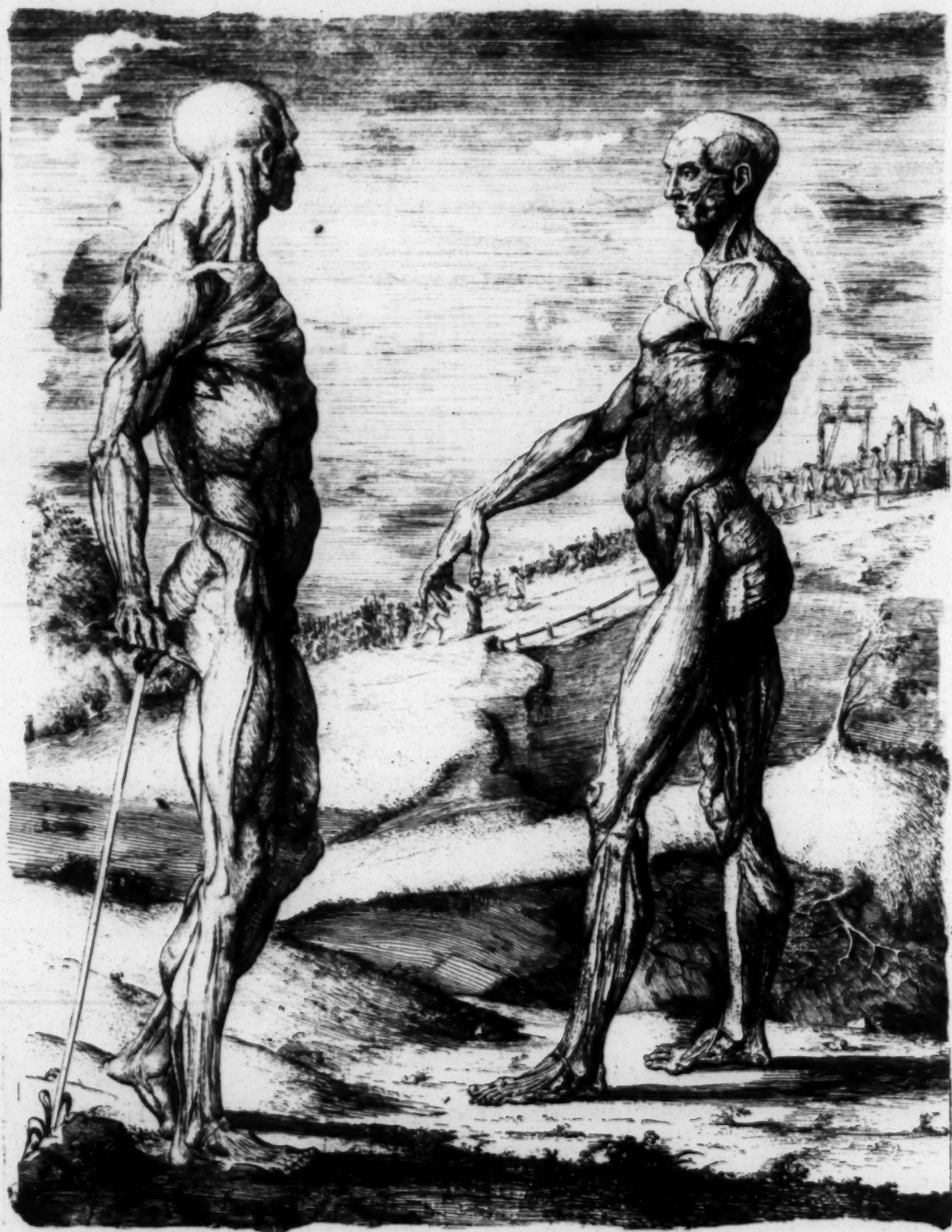
Ibid.

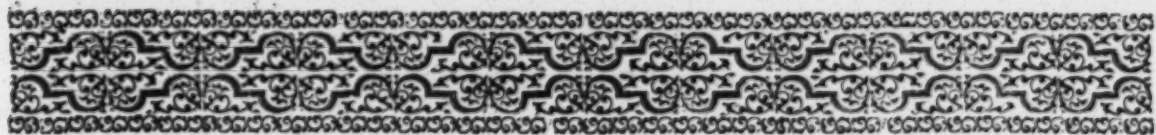
BY some called *Triceps Auris*, because it has sometimes three Beginnings. M. *Du Verney* says‡ it is composed of five or six *Fasciculi* of fleshy Fibres, which have their Origination from the superiour and fore part of the *Apophysis Mastoides*, and descend obliquely to their Insertion in the middle of the *Concha Auriculæ*.

* *Observat. Anatom.* † *Casseri*, lib. 4. cap. 4. ‡ *De l'Org. De l'Ouie.*

Of the MUSCLES of the AURICULA, &c.

N. B. *The Muscles of the internal Ear cannot be demonstrated, till after those of the Head are dispatch'd, and the Brain removed; but we shall follow the Example of others, and insert their Descriptions in this Place; it being also customary, in the Myological Lectures at Chirurgeons Hall, to shew them in a dried Preparation from the precedent Subject.*





CHAP. XII.

Of the MUSCLES of the INTERNAL EAR.



THESE Muscles were altogether unknown to the ancient Anatomists; but the most internal of those belonging to the *Malleus* is accurately described by *Bartholomæus Eustachius* *, and is called *Internus Auris*. *Volckerus Coiter* mentions † two Muscles latent in the second *Meatus* or *Concha*, commonly called *Tympanum*, but does not describe them. His Observations being made from Brutes, we suspect one of them was the internal Muscle of *Eustachius*, and the other the *Musculus Stapedis*. *Fabritius ab Aquapendente* ‡, and *Casserius Placentinus* **, contend for the Invention of another lying in the *Meatus Auditorius*, called *Externus*; in the Description of which they are followed by most Anatomists, except *M. Du Verny*, who (not taking notice of the Accounts of others, but writing from Dissection only) describes two Muscles belonging to the *Malleus*, but omits the external one of *Aquapendens* and *Placentinus*; and instead of it adds another, which he also calls *Externus*, because it lies on the external Bony *Paries* of the *Ductus*, leading from the Palate to the Ear, which from its Position we call *Obliquus Auris*. Hence it appears that three Muscles belong to the *Malleus*, of which the first, that appears in Dissection, is the *Externus* of *Aquapendens*; the second is the *Externus* of *Du Verny*, which we call *Obliquus Auris*; and the third is the *Internus* of *Eustachius*, to which may be added the fourth, belonging to the *Stapes*, called *Musculus Stapedis*, described by *Placentinus* in Brutes, and in Man by *Du Verny*.

FOR the better Demonstration of these Muscles, (after the Dissection of the Brain, and all the Muscles, which arise from, or are inserted into, the Basis of the Cranium) divide the *Os Temporale*, with part of the *Os Sphenoides* on one Side, and the *Os Occipitis* on the other, from the rest of the Bones, (it being well cleared of the Muscles, Membranes and Vessels, that remain on it;) then with a small semicircular Chisel cut away

* *Opuscula Anatomica.*† *Anatom. Observat.*‡ *De Aure pars prim. lib. 4. cap. 12.*** *De Aure, lib. 4. cap. 13.*

Of the MUSCLES of the INTERNAL EAR.

the inferiour Part of the Meatus Auditorius, taking care not to wound the Membrana Tympani. This performed, you must be very cautious in raising the Glandulous Membrane that invests the Meatus, to which the external Muscle adheres. The other two Muscles of the Malleus lying inclosed within the Os Petrosum, require our next Inspection. First observe the last named Bone's Conjunction to the Os Sphenoides, where with the Chisel lightly cut off their external Laminæ, and the oblique external Muscle of Du Verny will appear, together with the Internal one of Eustachius. But if you still proceed to break off more of the Os Petrosum, you will not only have a Prospect of the Bony Part of the Aquæduct, but of the Articulation of the Malleus with the Incus, and the whole Cavity of the Tympanum. Wherein may be observed the longer process of the last named Bone, articulated with the Stapes, by the mediation of the Os Orbiculare, and the Tendon of the Musculus Stapedis, running out of a Perforation in the Os Petrosum, down to its Insertion in the Head of the Stapes, together with the internal Surface of the Membrana Tympani, and the long Process of the Malleus lying on it.

XL.

*Tab. XXVI.
Fig. I. IV.*

EXTERNUS AURIS *vel* LAXATOR EXTERNUS.

THIS lies in the upper Part of the *Meatus Auditorius*, having a short fleshy Body with a long slender Tendon. It arises from the external and superiour Margin of the *Meatus Auditorius*, and soon becoming a slender Tendon, passes directly to the upper Part of the *Membrana Tympani*, on which it descends for some space to its Insertion in the long Process of the *Malleus*, where it is contiguous to the said Membrane. This draws the *Mambrium* of the *Malleus*, together with the *Membrana Tympani* forwards.

XLI.

*Tab. XXVI.
Fig. I. II.
III. IV. VIII.*

OBLIQUUS AURIS.

THIS may be also called *Semicircularis* from its Position, it lying in the external Part of the Bony Chancel of the *Aquæduct*, whence marching somewhat upwards and backwards, it enters the *Tympanum* in a very oblique Sinuosity excavated immediately above the Bone, where the *Tympanum* is inclosed, and is inserted into the slender Process of the *Malleus*. The Sinuosity, in which this Muscle passes, is that, which may be taken notice of in the upper Part of the Bony Circle of the *Factus*. This we don't find describ'd any where before *Du Verny*.

XLII.

XLII.

INTERNUS AURIS.

Tab. XXVI.
Fig. II. III.
IV. VIII.

THIS lies in a Bony Chancel in the *Os Petrosum*, which makes one of the *Parietes Tympani*. One part of this Chancel is without the *Tympanum*, and lies in the upper part of the Bony Passage, which goes from the Ear to the Palate; the other Part, which is within the *Tympanum*, advancing as far as the *Fenestra Ovalis*, makes in that Place a Rising, upon which, as on a Pulley, the Tendon of this Muscle passes to the other side of the *Tympanum*, and is inserted at the posterior Part of the Handle of the *Malleus*, a little below the Insertion of the external Muscle; by which means it draws it towards the *Os Petrosum*. The Origine of this Muscle is precisely in that Place, where the Bony Part of the *Aquæduct* terminates. It is covered with a nervous Coat, which forms a Sheath, accompanying it in its whole Progress, and binding it fast to the Chancel. When this Muscle acts, it pulls the *Manubrium* of the *Malleus* towards the *Os Petrosum*, whereby the external Surface of the *Membrana Tympani* becomes somewhat concave.

IN the Tendon of this Muscle, in some Animals, *Schellhammer* * informs us he has sometimes observed a small Bone: But we suspect he mistook the *Musculus Stapedis* for this Muscle, for in the Tendon of that my very good Friend, Dr. *Adair*, an accurate Anatomist, lately communicated his Observation of such an one to me, as it appear'd in a Calf's Head, which at first sight may deceive the Enquirer, it being annex'd to the *Stapes*, and in Figure like the *Ossiculum Quartum* of *Sylvius*; but if you be careful in your Examination, you may find both in the same Organ; the latter commonly remaining on the long Process of the *Incus* when separated: But if you leave the *Stapes* in *Situ*, you may see in that Animal the Origine, Progress, and Insertion of its Muscle, together with the Bone in its Tendon, as it passes over a Projection of the *Os Petrosum*, which composes the *Foramen Rotundum*, on which we suspect the Tendon of this Muscle acts, as on a *Trochlea*, to which end that small Bone is placed, not unlike the *Patella* of the Knee and *Ossa Sesamoidea* of the Feet; which is an elegant Mechanism in Nature.

XLIH.

MUSCULUS STAPEDIS.

Ibid.
Fig. III. IV.
VIII.

THIS lies hid in a Bony Pipe, excavated in the *Os Petrosum*, almost at the Bottom of the *Tympanum*, whence it takes its Origine. Its Belly is big and fleshy, and suddenly forms a very thin Tendon, which descends to its Insertion at the Head of the *Stapes*. The Pipe, which contains the Belly of

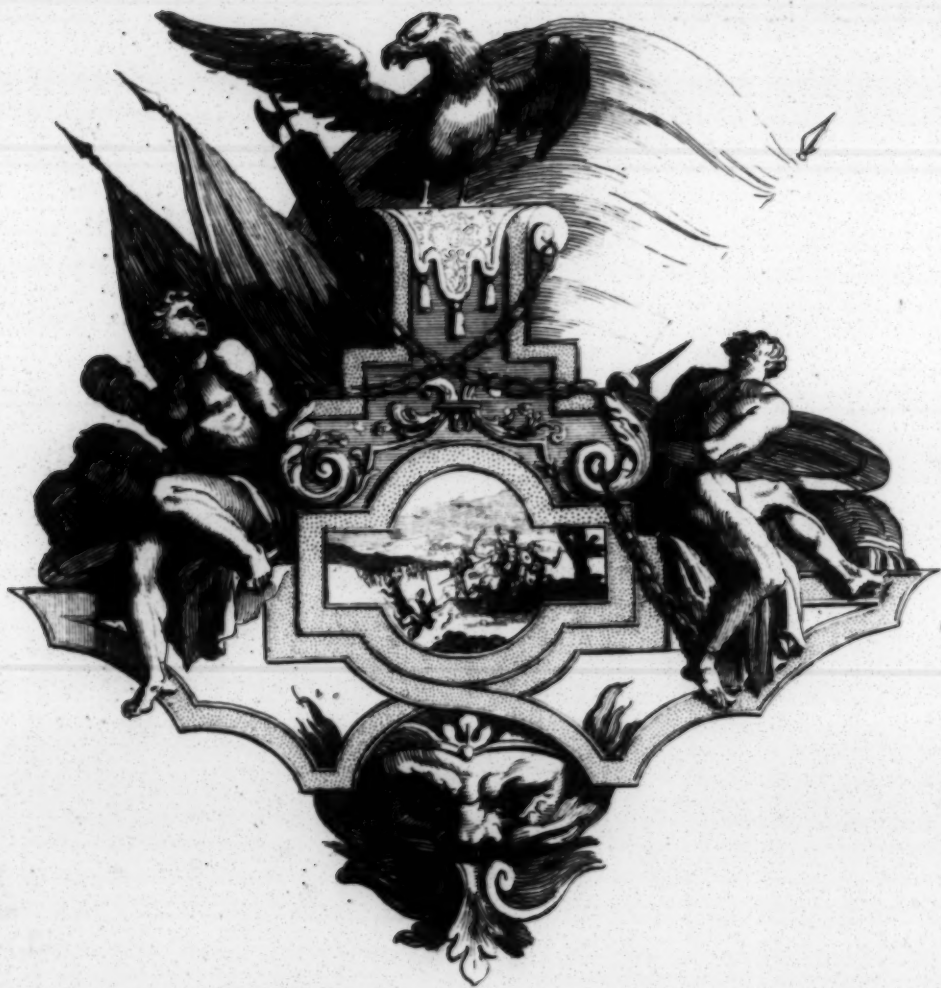
* Chap. III. Sect. IV.

Of the MUSCLES of the INTERNAL EAR.

this Muscle, is about the sixth part of an Inch long, and is much larger than the *Foramen*, through which its Tendon passes.

WHEN this acts, it draws the *Stapes* upwards to the *Foramen Ovale*.

THE Order of Dissection obliges us to examine the Muscles of the *Os Hyoides* next, to which end the *Mastoidei* must be raised on both sides of the Neck; the one being freed from its Origination, and left at its Insertion; the other on the contrary may be raised from its Insertion, and left at its Origine. This done, the *Biventral* Muscles of the Lower Jaw may be observed in their whole Progress, wherein may be noted, that they descend from their Originations, through the *Stylohyoidei*, to the *Os Hyoides*, where an *Annulus* is made on each side for the Transmission of their middle Tendons; after which they re-ascend to their Implantations. These being also raised contrariwise, like the above-mentioned *Mastoidei*, and the Perforations of the *Stylohyoidei* being enlarged, through which each contrary end of the *Digastrici* must be drawn, the one may be left at its Origination, and the other at its Insertion, till we come to describe the rest of the Muscles, which move the Lower Jaw.





CHAP. XIII.

Of the MUSCLES of the Os HYOIDES, or BONE of the TONGUE.



INCE the *Os Hyoides* is fastned to the Tongue and *Larynx*, the Muscles which move it ought to be esteemed common to both. Authors disagree concerning their Number, * *Vesalius*, † *Columbus*, ‡ *Spigelius*, &c. describe four Pair, (viz.) *Par Sternohyoideum*, *Coracohyoideum*, *Stylohyoideum*, and *Geniohyoideum*. To these the accurate ** *Falloppius* adds another Pair, which latter Anatomists call *Mylohyoideum*, the Invention of which is claimed by

Riolan, in his *Animadversions on Caspar Baubin's Theatrum Anatomicum*.

ALL these Muscles of the *Os Hyoides* receive their Denominations from their Originations and Insertions.

XLIV.

STERNOHYOIDEUS.

Tab. XXII.
XXIII.
XXVII.

THIS does not arise from the upper part of the *Sternum*, as Anatomists generally write, but from the internal Part of the *Clavicula* next it, where its Origination is broad and fleshy, and ascends directly over the *Sternothyroideus* and *Larynx*, of an equal Breadth and Thickness, to its Insertion at the *Basis* of the fore Bone of the *Os Hyoides*.

THIS with its Partner acting, pull the *Os Hyoides*, together with the Tongue and *Larynx*, directly downwards.

* *Lib. 2. Cap. 17.*

† *Lib. 5. Cap. 12.*

‡ *Lib. 4. Cap. 6.*

** *Observ. Anatom.*

XLV.

CORACOHYOIDEUS.

Tab. XXII.
XXVII.

THIS does not arise from the *Processus Coracoides Scapulae*, as some Anatomists pretend, its Origination being round and fleshy from the superiour *Costa* of the *Scapula*, at the root of the said Process; whence marching obliquely under the *Mastoides*, it becomes tendinous; but growing fleshy again, its inserted into the fore Bone of the *Os Hyoides*, near the Implantation of the former Muscle.

THIS running under the *Mastoides*, as on a *Trochlea*, it there becomes tendinous, not unlike the *Digastricus* of the Lower Jaw; wherefore this by some is also called *Biventer*. When it acts together with its Partner, they do not only assist the former in drawing the *Os Hyoides*, Tongue and *Larynx*, downwards; but they also pull them somewhat inwards, towards the *Vertebrae* of the Neck.

XLVI.

STYLOHYOIDEUS.

Tab. XXIII.
XXIV.
XXVII.

ARISES sharp and tendinous from the Root of the *Processus Styloides*, and soon growing fleshy, descends obliquely forwards to the *Os Hyoides*. In half its Progress, its fleshy Body is commonly divided, for the Transmission of the middle Tendon of the *Digastricus* of the Lower Jaw. After which it becomes tendinous near its Implantation into the fore and Side Bone of the *Os Hyoides*.

* Tab.
XXVIII.
Fig. III. X.
† Ibid. V.

BESIDES this, I have frequently found another Muscle*, that arises round and fleshy from the *Processus Styloides*; and accompanying the Ligament† between that Process and the *Os Hyoides*, is inserted tendinous with it into the *Appendiculum* of that Bone. But this not being found in all Bodies, ought not to be esteem'd a regular Muscle.

THESE Muscles with their Companions, the *Styloglossi* and *Stylopharyngæi*, acting on each side, do draw up the *Os Hyoides*, Tongue and *Larynx*, together with the *Fauces* in Deglutition; whereby the masticated Aliment is not only compress'd into the latter, (they being then dilated) but the *Epiglottis* is depress'd, and adequately covers the *Rimula* of the *Larynx* by its Approximation to it, by which means the Descent of any part of the Aliment into the *Aspera Arteria* is hindered; which Mechanism in Nature is indeed very admirable.

XLVII.

MYLOHYOIDEUS.

Tab. XXIII.
XXVII.

THOUGH *Fallopius* makes this a pair of Muscles, it seems not to be divisible without apparent Violence. It possesses all that Space which is between the Lower Jaw and *Os Hyoides*; arising fleshy from both sides the Mandible internally,

nally, near the *Dentes Molares*, whence it marches with a double Order of fleshy Fibres, the outward and lowermost of which pass directly to their Implantation in the *Os Hyoides*; and those in the middle run transversely over the following pair of Muscles, being inseparably joined to each other with a middle Line.

BESIDES the Uses commonly ascribed to this Muscle in moving the *Os Hyoides* Tongue, and *Larynx*, upwards and forwards, and to either Side, its last described transverse Order of Fibres have still a farther Use in compressing the *Glandule Sublinguales* which lie immediately under them on each side; whereby they hasten the Egress of the Spittle from the inferiour Salival Ducts into the Mouth. Hence it is we employ these Muscles, when *Saliva* is wanting to moisten the Mouth and to join with the Aliment, when Mastication is not required; which Artifice of Nature deserves our Admiration.

XLVIII.

GENIOHYOIDEUS.

Tab. XXIV.
XXVII.

THIS with its Partner are short, thick, and fleshy Muscles. They arise from the internal Parts of the Lower Jaw-Bone called the Chin, and dilating themselves, are soon lessened again, and inserted into the superiour part of the fore Bone of the *Os Hyoides*.

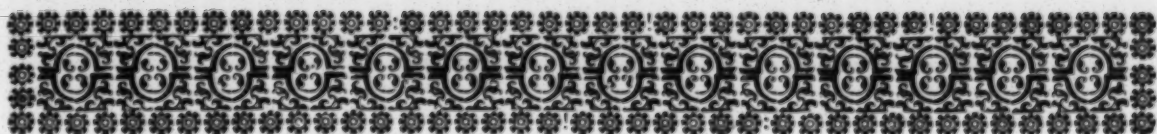
THESE acting, pull the *Os Hyoides*, &c. both upwards and forwards, and assist the *Genioglossi* in thrusting the Tongue out of the Mouth; of which in the following Chapter.

ALL these Muscles of the *Os Hyoides* being raised from their Originations, and left at their Insertions, the whole Bone together with them may be taken out, by dividing its two Extremes from the two Processes of the Scutiform Cartilage, and cutting off the Originations of the *Ceratoglossi* and *Hyothyroidei*, (of which hereafter.) This done, they may be expanded on a Plain, as they are represented in Tab. XXVII.



L

CHAP.



CHAP. XIV.

Of the MUSCLES of the TONGUE.

Tab. XXVIII.
Fig. 1.

OR the Motion of this Part, Authors assign various Numbers of Muscles; some reckoning eight, others nine, some ten, and others eleven, amongst which they count the Tongue it self.

N. B. The Muscles of the Tongue, like those of the *Os Hyoides*, are named from their Originations and Insertions.

XLIX.

GENIOGLOSSUS.

THIS with its Partner lie immediately under the *Geniobyoides*. They arise fleshy from the fore part of the Lower Jaw internally, and enlarging themselves, are inserted into the middle part of the whole Body of the Tongue, according to its Length; and part of them sometimes passes to the *Os Hyoides*.

By the Action of the different Series of Fibres of these Muscles the Tongue is either drawn in, or thrust out of the Mouth.

L.

CERATOGLOSSUS.

Tab. XXIV.
XXVIII.
Fig. 1.

THIS, in the Order of Dissection above-mention'd, we cut from its broad fleshy Origination at the upper part of the *Os Hyoides* laterally, whence it ascends to its broad and fleshy Insertion at the Root of the Tongue.

THESE Muscles acting together draw the Tongue into the Mouth directly; if one of them acts alone, it draws it to one Side.

LI.

STYLOGLOSSUS.

Tab. XXIV.
XXVIII.
Fig. 1.

HAS a small fleshy Origination from the *Apex* of the *Processus Styloides*, whence descending obliquely forwards, it is inserted into the Root and Side of the Tongue, partly under the Insertion of the former.

THIS pulls the Tongue upwards and inwards in the Action of Deglutition, as before noted.

IN my former Edition I question'd the Existence of a Pair of Muscles call'd *Basioglossi*, on the Authority of *Fallopius* and *Julius Casserius*; but having since carefully examin'd all the Muscles of this Part in divers Subjects, I have found them agreeable to the following Description.

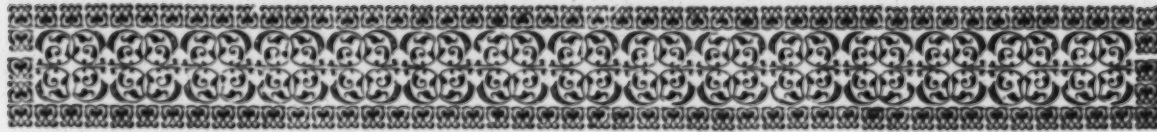
LII.

BASIOGLOSSUS.

Tab. XXVIII.
Fig. 1.

THE Fibres of this Muscle, at their Origine from the *Basis* of the *Os Hyoides*, are intersected by the hinder Parts of the *Genioglossus*, but afterwards they pass distinctly according to the Length of the Tongue to its Tip.





CHAP. XV.

Of the MUSCLES of the UVULA.



ALLOPPIUS mentions the second and third of these Muscles among those of the *Fauces*; but *Riolan* first ascribed them to this Part, and call'd them *Pterygostaphylinus Internus* and *Externus*. The Discovery of the *Glossostaphylini* is owing to *Val-salva*.

LIII.

GLOSSOSTAPHYLINUS.

Tab. XXVIII.
Fig. II.
Tab. XXIX.
Fig. I. II.

IS a very small Muscle, consisting but of two or three *Fasciculi* of fleshy Fibres, which lie immediately under the Glandulous Membrane of the *Fauces*, and make those two Risings, which we see on this Side the *Amygdalæ*, when we inspect these Parts in living Subjects. They arise on each Side the Tongue, near its Root, and after a bending Progress are expanded on the fore part of the *Uvula*.

THEIR Use is to bring the *Uvula* downwards.

LIV.

SPHENOSTAPHYLINUS.

Tab. XXVIII.
Fig. II. IV.
Tab. XXIX.
Fig. I. II.

THIS descends from its Origination at a Process of the *Os Sphenoides*, which is in a direct Line between the *Ala Vespertilionis* and *Processus Styloides*, and becoming a round fleshy Belly, in half its Progress grows less again, near its lateral Insertion into the posterioir Part of the *Uvula*.

THIS with its Partner acting draw the *Uvula* upwards and backwards, which hinders the masticated Aliment from regurgitating through the *Foramina Narium* in *Deglutition*.

LV.

LV.

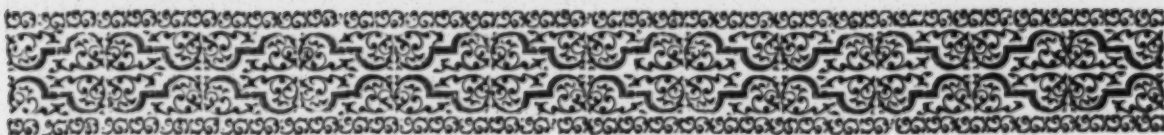
PTERYGOSTAPHYLINUS.

Tab. XXVIII.
Fig. II. IV.
Tab. XXIX.
Fig. I.

THIS arises from the same Process of the *Os Sphenoides* as the preceding Muscle, and like it descends according to the length of the Interstice made by the internal *Ala* of the *Os Sphenoides* and *Musculus Pterygoideus Internus* of the Jaw; and becoming tendinous, marches over the *Processus Pterygoideus*, and is inserted into the fore part of the *Uvula*.

THE Tendon of this passes over the Pterygoid Process, which like a Pulley gives it a different Direction from that of the former Muscle, though they have both their Origine from the same Place. Wherefore, contrary to the preceding, this draws the *Uvula* forwards and downwards; which contrivance in Nature is no less remarkable than any of those, where the like Artifice of a *Trochlea* is made Use of.





CHAP. XVI.

Of the MUSCLES of the FAUCES.



HE Discovery of these Muscles is assumed by * *Riolan*, tho' they were described before him by † *Fallopius*. Neither *Vesalius*, nor *Columbus*, mentions these Muscles of the *Fauces*, or those of the *Uvula*, though the Muscles of the *Fauces* are partly described by *Galen*, *Oribasius*, and *Avicenna*, as ‡ *Laurentius* observes. Later Writers have followed the erroneous System of *Riolan*, who, as I am apt to think, either received *Fallopius's* Account implicitly, or else was not willing to diminish the Number of Muscles belonging to the *Fauces*, described by *Fallopius*, lest it should appear that those of the *Uvula* were also described by him.

LVI.

STYLOPHARYNGÆUS.

Tab. XXVIII.
Fig. II. III.
Tab. XXIX.
Fig. I. II.

THIS has a round fleshy Origination at the Root of the *Processus Styloides*, (with the *Styloglossus*) whence descending obliquely, it expands it self at its Termination on the Internal Glandulous Membrane of the *Fauces*, in the middle of which 'tis joined with its Partner.

THESE acting draw the *Fauces* upwards, and dilate them in order to receive the masticated Aliment in *Deglutition*.

LVII.

OESOPHAGÆUS, seu SPHINCTER GULÆ.

Tab. XXVIII.
XXIX.

ARISES with various Courses of fleshy Fibres from most of the neighbouring Parts, as is particularly express'd in Tab. XXVIII. XXIX. and is inserted into the lateral and back Parts of the *Gula*.

* *Animadv. in Spigel. & Vessing.*

† *Observ. Anatom.*

‡ *Hist. Anatom. lib. 5. cap. 9.*

Of the MUSCLES *of the* FAUCES.

43

ITS Use is to thrust the masticated Aliment, by its Compression, through the *Gula* towards the Stomach.

LVIII.

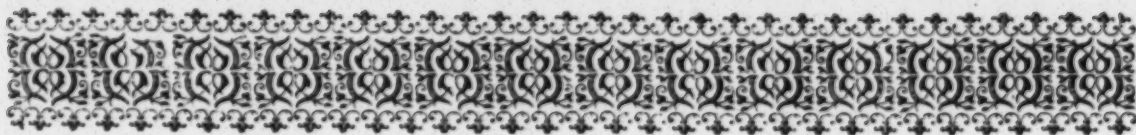
VAGINALIS GULÆ.

Ibid.

STENO supposes this to consist of a double Order of spiral Fibres mutually intercrossing each other. Dr. *Willis* * says the whole *Oesophagus* seems to consist of two Muscles, which make four Parallelograms with their opposite Fibres decussating each other. But in Man we find it far otherwise, in whom the Fibres of this Muscle are longitudinal, and oblique; the former seem to take their Original at the Arytænoidal Cartilages, and passing somewhat obliquely to the back part of the *Oesophagus*, descend to the Stomach. The latter seem to be a Continuation of the *last treated of Muscles*, descending obliquely in a spiral manner not unlike those of the Intestines.

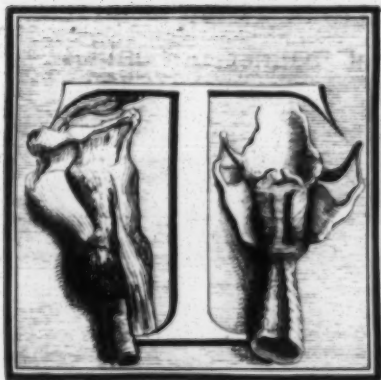
* *Pharma. Rational. cap. 2. Sect. 2.*





CHAP. XVII.

Of the MUSCLES of the LARYNX.



THESE Muscles of the *Larynx* are generally divided into *Common* and *Proper*.

THE *Common* arise from other Parts, and are inserted into the *Larynx*, concerning which *Galen* and the ancient Anatomists erred in their Accounts, reckoning three Pair, of which the *Oesophagus* is esteemed as one pair of Muscles. But this Mistake is corrected by * *Fabritius ab Aquapendente*, the *Oesophagus* being but one single Muscle, and be-

longing to the *Gula*, wherefore the common Muscles of the *Larynx* are reckon'd to be two Pair only; (*viz.*) *Par Sternothyroideum* and *Hyothyroideum*.

THE *Proper* Muscles of this Part are such whose Rise and Termination are confined to the Cartilages themselves. † *Falloppius* and *Placentinus* have both employ'd themselves in their Description. These are four Pair, besides one single Muscle, (*viz.*) *Par Cricothyroideum*, *Cricoarytænoideum posticum*, *Cricoarytænoideum laterale*, *Thyroarytænoideum*, and the *Arytænoideus*.

N. B. That all these Muscles of the *Larynx* have their Denominations from their Originations and Insertions.

LIX.

STERNOTHYROIDEUS.

Tab. XXIV.
XXVIII.
Fig. III.
Tab. XXX.
Fig. I.

THIS arises broad and fleshy from the upper and internal Part of the *Sternum*, whence ascending on the Sides of the Wind-pipe over the *Glandula Thyroidea*, it's inserted into the whole length of the Thyroidal or Scutiformal Cartilage from its Basis to its upper Process. This with its Partner pulls the *Larynx* downwards, and lengthens the *Canalis* or Distance between the *Rimula*, and Tip of the Tongue, (which latter we take to be the true *Plectrum Vocis*) whereby the Tone of the Voice is render'd grave.

* *De Lar. cap. 8.*

† *Observat. Anatom.*

LX.

HYOTHYROIDEUS.

Ibid.

THIS arises fleshy from the inferior Part of the *Os Hyoides* laterally, opposite to the Origination of the *Ceratoglossus*, and descends directly to the Side of the Scutiform Cartilage, near the Implantation of the former.

THIS with its Fellow draw the *Larynx* upwards in an acute Tone of the Voice; the Canal of the *Aspera Arteria* being also straitned thereby.

WE proceed next to the *Proper Muscles* of the *Larynx*.

In order to the Administration of these, the Musculus Œsophagus must be freed from both sides the Scutiform Cartilage, the Arytænoidal Cartilages cleared from the Glottis, and the Aspera Arteria separated from the Gula.

LXI.

CRICOTHYROIDEUS.

*Tab. XXVIII.
Fig. III.
Tab. XXX.
Fig. I. II.
III.*

THIS is seated on the fore part of the *Larynx*, and is a short thin fleshy Muscle, with a double order of Fibres decussating each other, arising from the fore part of the *Cricoides*, whence marching obliquely, it is soon inserted into the *Scutiformis* internally and laterally.

THIS by * *Galen* and † *Vesalius* is made two Muscles; but in separating the inferior Processes of the Scutiform Cartilage from the *Annularis*, you will find but one on each Side, says ‡ *Fabritius ab Aquapendente*: The Origination and Insertion of which is supposed by some to be *e contrario*, and that its Use is rather to pull up the *Annularis*, than to bring down the *Scutiformis* nearer it; but this Controversy (we think) is of no moment, since all Muscles move the Parts less stable to those more fix'd.

LXII.

CRICOARYTÆNOIDEUS POSTICUS.

*Tab. XXX.
Fig. II. III.
IV. V.*

ARISES from the posterior part of the Annular Cartilage, filling a shallow Depression of it, with Fibres ascending obliquely outwards, to their Insertion at the lowermost part of the Arytænoidal Cartilage.

THIS with its Partner serve for the opening of the *Rimula*; which will plainly appear, if with your Knife you repress this Muscle, the Arytænoidal Cartilage being opened thereby.

* *De Musc.* † *Lib. 2. Cap. 21.* ‡ *Fabrit. de Laryn. c. 8.*

LXIII.

CRICOARYTÆNOIDEUS LATERALIS.

Ibid. Fig.
III. IV. V.

THIS is the smallest Muscle of the *Larynx*. It arises from the *Cartilago Cricoides* laterally, and ascending obliquely, is inserted into the Arytænoidal Cartilage near the Implantation of the former.

THIS pulls the *Arytænoides* sideways, and thereby opens the *Rimula*.

LXIV.

THYROARYTÆNOIDEUS.

Ibid.

THIS is the largest of all the proper Muscles of the *Larynx*. It has a broad, disgregated, fleshy Original from the internal and concave Part of the Scutiform Cartilage, whence it passes with a double Order of Fibres, which decussate each other near their Insertion, to the Arytænoidal Cartilage.

ITS Use is to draw the Arytænoidal Cartilages nearer to each other, and shut the *Rimula*.

LXV.

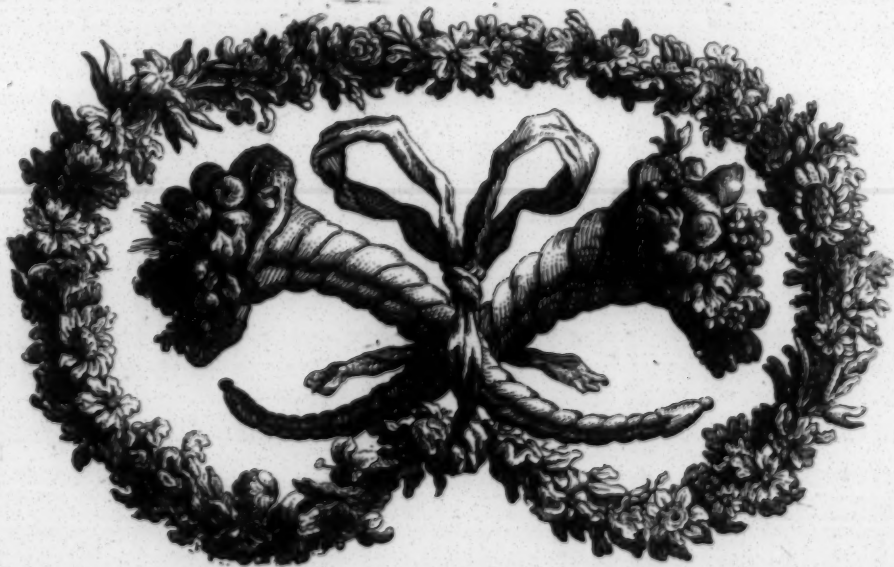
ARYTÆNOIDEUS.

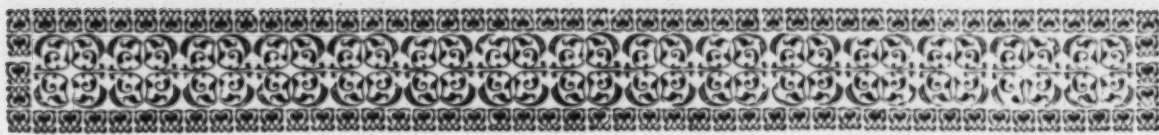
Ibid. Fig. II.
III. IV. V.

THIS Muscle has no Partner. It arises from the external part of one of the Arytænoidal Cartilages, and running transversely is inserted into the other.

THIS pulls the Arytænoidal Cartilages close together, and entirely shuts the *Rimula*.

N. B. Now all the Muscles of the Lower Jaw may be dissected; its Depressors being left at their respective Originations and Insertions, as before.





CHAP. XVIII.

Of the MUSCLES of the LOWER JAW.



FIVE Pair of Muscles are employ'd in the Motion of the Lower Jaw: Four of which were described by * *Vesalius* and the preceding Anatomists; but, for the Discovery of the fifth we are oblig'd to *Fallopius*. To these *Riolan* adds a sixth Pair, namely, the *Quadrati Genarum*, which we have already described among the Muscles of the Cheeks and Lips.

LXVI.

TEMPORALIS, seu CROTAPHITES.

Tab. XXIII.
XXIV. XXXI.

THIS has a large, semicircular, fleshy Beginning, from part of the *Os Frontis*, *Sincipitis*, *Sphenoides*, and *Temporale*. From these Places its Fibres pass (like Lines drawn from a Circumference to a Center) under the *Os Jugale*, from which also arise some fleshy Fibres joining with the former at their united, partly tendinous and partly fleshy Insertion, into the upper part of the *Processus Corone* of the Lower Jaw.

THIS with its Partner draws the Lower Jaw upwards. We could never observe those dreadful Symptoms Authors tells us of in Wounds of this Muscle, though part of it has been taken away to apply the *Trepan* in Fractures of the *Cranium*.

A VERY remarkable Instance of which we have in an old Woman now living in *Little Chelsea*; who had not less than two thirds of this Muscle above the *Os Jugale* cut away, in order to remove the pieces of broken Scull underneath it, by which the *Dura Mater* was laid bare two Inches one way, and not less than an Inch and half the other. This Woman recover'd under the Care of Mr. *Tooley*, an experienc'd Surgeon in *Chelsea*, and my self.

* *Lib. 2. Cap. 15.*

LXVII.

MASSETER.

Tab. XXIII.
XXXI.

IS a short, thick Muscle, partly fleshy, and partly tendinous. It arises forwards from the first Bone of the upper Jaw, backwards from the *Os Jugale*, and some of its Fibres are continued from the *Temporalis* under the last named Bone. Thence descending with Fibres intersecting each other in acute Angles, it is inserted into the lower and external part of the under Jaw-Bone.

THIS assists the former in its Office. The passing of the *Ductus Salivaris Superior* over this Muscle is a provident contrivance of Nature, to press out the *Saliva* in Mastication. The next Muscle which presents it self is the *Digastricus*, by some call'd *Graphoideus*, because they imagine it to arise from the Styloidal Process.

LXVIII.

DIGASTRICUS, seu BIVENTER.

Tab. XXIII.
XXXI.

SO called from its Figure, it being composed of two Bellies. It arises fleshy from a *Sulcus* near the internal and back part of the *Processus Mastoideus*, under part of the *Complexus*; whence descending, it becomes tendinous, passing through the *Stylobryoideus*, and an annular Ligament, or sometimes a membranous Inclosure, laterally fastned to the *Os Hyoides*; to which Bone it is likewise fastned by some tendinous Fibres detached from its middle Tendon. Thence it ascends to its Insertion at the middle of the inferiour part of the Lower Jaw. The passage of the middle Tendon of this Muscle through the Annular Ligament fix'd to the *Os Hyoides*, like a Rope through a Pulley, is a wonderful contrivance of the Author of Nature to render it capable of pulling down the Lower Jaw, which, had its Progress been direct from its Origination, could not have been perform'd. Nor are there any Processes, whether of the *Vertebrae* of the Neck, or the neighbouring Parts, that could give an Origination to these Muscles, below their Insertions, as in some *Quadrupeds*: Wherefore the Divine Architect of human Bodies has placed these Pullies below the Terminations of these Muscles, whereby they are enabled to pull down the Lower Jaw and open the Mouth. The Pullies being fix'd to the *Os Hyoides*, the Action of these Muscles is necessarily interrupted in Deglutition, because the Tongue, *Larynx*, and the *Os Hyoides*, are all rais'd upwards in swallowing, and consequently, at that time, the Digastrick Muscles cannot act. Hence it is, that, when we swallow our Aliment, the under Jaw is drawn towards the upper, and the Mouth is shut. But in Dogs, and perhaps in other voracious Animals, where these Muscles pass directly from their Origines to their Insertions, these two Actions of depressing the Lower Jaw, and raising the *Os Hyoides*, do not interfere with each other, which may be one reason why these Creatures devour their Food so speedily.

LXIX.

LXIX.

PTERYGOIDEUS INTERNUS.

Tab. XXXI.

SO called from its Origine and Situation. It arises partly tendinous, and partly fleshy, from the *Processus Pterygoides*, or *Aliformis*, of the *Os Sphenoides*, whence it descends to its Implantation at the internal and inferior part of the Lower Jaw, opposite to the Termination of the *Masseter*,

EITHER of these acting, draws the Jaw to the contrary Side; if both act, they assist the *Temporales* and *Masseteres*.

IN a Subject I lately dissected I observed an elegant distinct Muscle, tho' very small. This arose fleshy from the extremity of the *Processus Styloides*, but soon became tendinous, and was so inserted immediately above the external lower Angle of the under Jaw, between the Terminations of the *Masseter* and *Pterygoideus Internus*. Tab. XXXI.
E.

N. B. To discover the following Muscle the *Temporalis* and *Masseter* on either side must be removed. But if you still desire a fairer Prospect of it, with a Chissel cut off part of the *Processus Corone*, together with the *Os Jugale*.

LXX.

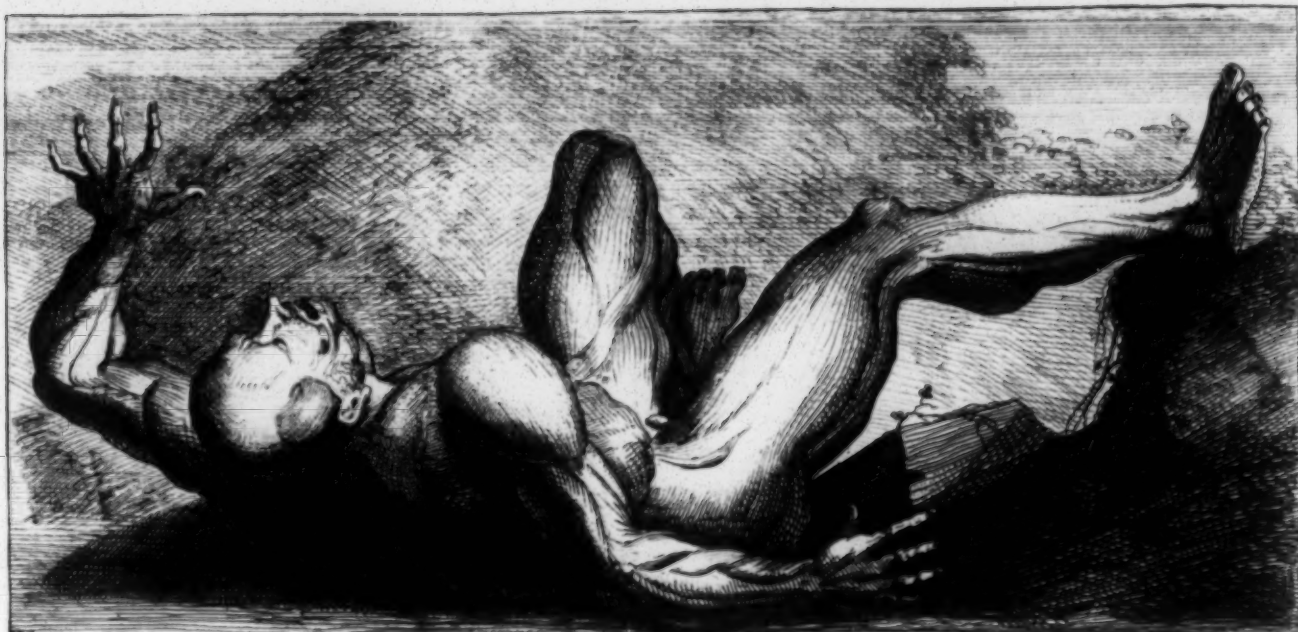
PTERYGOIDEUS EXTERNUS.

Tab. XXIV.
XXXI.

THIS, like the former, receives its Name from its Situation and Origine: it arising from the external Part of the said *Processus Pterygoides*, and superior Part of the *Os Sphenoides* seated in the cavity of the Temples, opposite to the *Os Jugale*, whence it runs backwards to its Insertion at the Neck of the *Processus Condylodes* of the Lower Jaw.

WHEN this and its Partner act, they draw the Lower Jaw forwards, and force the Teeth of the Lower Jaw beyond those of the Upper, as *Falloppius* * their first Describer observes.

* *Observat. Anatom.*



CHAP. XIX.

Of the MUSCLES of the THORAX.



THE Muscles of the *Thorax* may be divided into *Proper* and *Common*.

THE *Proper* Muscles have their Rise and Termination within the Limits of the *Thorax*, as the *Intercostales*, the *Triangularis*, and the *Serrati Postici*.

THE *Common* are such Muscles used in moving the *Thorax*, as take either their Origine, or Insertion, from other Parts. Of these some are Principal, having their Insertions in the *Thorax*, and immediately contributing to its Motion, as the three *Scaleni*, the two *Serrati Antici*, the *Subclavius*, Dia-

phragm, and *Sacrolumbalis*, which last we reckon among the Muscles of the *Thorax*, in compliance with other Anatomists, though it might perhaps be more properly placed among those of the Back. Other of the common Muscles may be called auxiliary, as moving only the neighbouring Parts, whose Actions are in some degree serviceable to the Motion of the *Thorax*, of which sort are the Muscles of the *Scapula*. For in extraordinary Inspirations the Elevation of the *Scapulae* is necessary, since the *Serrati Antici* cannot act in raising the Ribs without it. Whence an Account may be given, why Respiration is less free, when the Arms are employ'd in any laborious Action. Thus likewise in Asthma's, Peripneumonies, Pleurifies, and other Cases, wherein the Organs of Respiration are inflamed, or otherwise obstructed in the due execution of their Office, the Extension of the Neck becomes necessary, in order to give liberty to the *Scaleni* to assist in raising up the Ribs.

BUT

BUT though this Division of the Muscles of the *Thorax* be commodious enough for learning and retaining in memory their several Uses, yet it will be more agreeable to our present Design, to treat of them in such order, as they are most easily rais'd in the course of Dissection. For which reason we shall take leave to divide them into, *such Muscles of the Thorax as appear on its fore part, The Muscles of the Scapula, and Those Muscles of the Thorax, that appear on its back part.*

FIRST then of *those Muscles which appear on the fore part of the Thorax.*

LXXI.

SERRATUS MINOR ANTICUS.

Tab. II. V.
XXXII.

ANATOMISTS generally reckon this Muscle amongst those of the *Scapula*; but we are persuaded from its Position, that it may be equally serviceable to the *Thorax*, in elevating those Ribs it is inserted into. Wherefore we offer it indifferently, whether belonging to one, or the other; but choose to insert it in this place, because it now appears in *Situ*. If due Care be not taken in raising the *Pectoralis*, you will be in danger of wounding this. It arises fleshy from the *Processus Coracoides Scapulae*, and descends obliquely forwards, becoming broader and thinner, and is inserted fleshy into the Bony Part of the second, third, and fourth Ribs. If the *Scapulae* are elevated by their proper Muscles, this with its Partner are then capable of dilating the Breast in large Inspirations: But if those are depress'd, it may be easily conceived with what difficulty that Action must then be perform'd.

Ibid.

LXXII.

SERRATUS MAJOR ANTICUS.

THIS arises fleshy from the whole *Basis Scapulae*, and passing under the *Subscapularis*, it becomes broader and thicker, still running somewhat forwards, till its inserted into the eight superiour Ribs laterally, by so many distinct fleshy Portions, or *Digituli*, representing the Teeth of a Saw; the two and sometimes three inferiour of which are indented with the *Obliquus Descendens* of the *Abdomen*, as was before noted. This like the former dilates the *Thorax*, or moves the *Scapula* forwards and downwards, when its Muscles are relaxed.

THE next Muscle of the *Thorax*, that appears as the Body lies supine, is the *Diaphragm*, which is a singular Muscle, elegantly framed for those Uses, for which the Author of Nature has design'd it.

LXXIII.

LXXIII.

SUBCLAVIUS.

Tab. II. V.
VI. XXXIII.

ARISES fleshy from the inferiour part of half the *Clavicula*, next its connection with the *Spina Scapulae*; hence its Fibres descend obliquely forwards, and it becomes a round Tendon at its Insertion into the superiour part of the first Rib near the *Sternum*. Its Use is intimated above; but * *Spigelius*, who has written a Chapter expressly about this Muscle, pretends it depresses the *Clavicula*; for which Opinion he argues strenuously, and to this purpose relates an Observation from *Hippocrates*, that when the *Clavicula* is fractured near the *Sternum*, that next part visibly ascends, and that part next the *Scapula*, together with the *Humerus*, falls down; but if its fractur'd near the *Scapula*, then neither part rises; which, as our Author conjectures, seems to depend on the Termination of this Muscle. In the first case, it draws part of the *Clavicula*, together with the *Humerus* downwards, the Fracture being betwixt its Insertion and the contrary end of the Bone, that is fix'd to the *Sternum*. In the latter, the Fracture being made in that part, where this Muscle is inserted, it must keep the ends of the Bone in the same posture, as before the Accident.

LXXIV.

SCALENUS PRIMUS.

Tab. III. VI.
XXXIII.

THIS arises fleshy from the fore part of the fourth and fifth, and sometimes likewise from the sixth, transverse Processes of the *Vertebrae* of the Neck, and descending obliquely forwards, becomes tendinous at its insertion into the first Rib. The Axillary Nerves pass between this and the following Muscle.

ITS Use is to draw the superiour Rib, together with the rest, upwards in Inspiration.

LXXV.

SCALENUS SECUNDUS.

Tab. III. V.
XXXIII.

THIS springs fleshy from the third, fourth and fifth transverse Processes of the *Vertebrae* of the Neck laterally; in its Descent it becomes thin and tendinous, marching, over the first Rib, to its Insertion into the second, and sometimes the third.

* *Lib. 4. Cap. 9.*

LXXVI.
SCALENUS TERTIUS.

Tab. III.
XXXIII.

THIS has its Beginning near the former from the transverse Process of the sixth *Vertebra* of the Neck, and is soon inserted into the first Rib.

THESE three last Muscles are called *Scaleni* from their Figure, having three unequal Sides. Though they are most commonly reckon'd among those of the Neck, to whose Motion they are subservient, yet the judicious * *Falloppius*, duly considering the *Subclavius* and *Serratus Superior Possicus* to be insufficient for the Elevation of the Chest, assigns these part of that Office.

THE Sternum being raised, by dividing the Cartilages on each side from the Bony Endings of the Ribs, the following Muscle will appear underneath.

LXXVII.
TRIANGULARIS.

Ibid.

THIS with its Partner lies on each side the *Cartilago Ensiformis*, within the Cavity of the *Thorax* under the *Sternum*; sometimes it appears to be three, at other times four distinct Muscles on each side. It arises from the inferior Part of the *Os Pectoris*, whence its upper part ascends, and the lower descends to its Implantations at the Bony Endings of the fourth, fifth, sixth, and sometimes seventh and eighth Ribs, near their Conjunctions with their Cartilages.

ITS Use is to contract the Breast.

THE next Muscle of the *Thorax*, that appears as the Body lies supine, is the *Diaphragm*, which is a singular Muscle, elegantly framed for those Uses, for which the Author of Nature has design'd it.

LXXVIII.
DIAPHRAGMA.

Tab. XXXIV.
XXXV.

† **S**TENO supposes this to be a Digastric Muscle. ‡ *Caspar Bartholin* conceiving it double, calls the lower Part, springing from the *Vertebra* of the Back and Loins, the *Musculus Inferior*, and the opposite arising from the Cartilaginous Endings of the Ribs, the *Superior*; or imagines it Trigastrical, as above noted, Chap. I. Which latter Opinion of his seems to quadrate to this Part in Birds. But whether we may suppose it one or two Muscles in Man, is a Matter more of Controversy than use. Its inferior part arises partly tendinous and partly fleshy on the Right Side, from the first, second, and third *Vertebra* of the Loins; on the Left from the last, and last but one of the Back: Hence it ascends with fleshy Fibres, which run streight on each side, but in the middle pass somewhat curvedly,

* *Observ. Anatom.*

† *Specim. Myologiae.*

‡ *Diaphr. Stru&ur. cap. 2.*

P

and

and intersecting each other, do as it were embrace the *Oesophagus*; after which they become tendinous, and join with its upper part, which arises thin and Membranous, but soon growing fleshy, from the whole inferior Margin of the cartilaginous endings of the Ribs, and lower part of the *Os Pectoris*; whence, its fleshy Fibres, like Lines drawn from a Circumference towards a Center, pass to its middle part, where its tendinous Fibres intercross each other, and exhibit a *Rete*. It has two large Perforations, the one in its tendinous part, to transmit the *Vena Cava* towards the right Auricle of the Heart; the other in its fleshy part, which, like an *Annulus*, embraces the *Oesophagus*, (as above noted). Its double Origine at the *Vertebrae* gives way to the descending Trunk of the *Arteria Magna*, and two ascending of the *Ductus Chyliferus* and *Vena Azygos*.

ITS Use in the Animal Economy is too large to be inserted in this place. *Pecquet* observes, that when all the Muscles of Respiration are separated and removed, the *Diaphragma* and *Intercostales* excepted, the Animal still persists to breathe. When we inspire, its superior Surface comes towards a Plain. In Expiration it's convex towards the *Thorax*, and concave towards the *Abdomen*. In the former the *Viscera* of the lower Belly are compress'd, and the Cavity of the *Thorax* enlarged. In the latter the Air is express'd out of the *Vesiculae* of the Lungs.

THE *Thorax* being now laid open, the *Heart* and *Lungs* may be taken out. After which you may raise the *Pleura*, beginning at the Division of the Ribs from their cartilaginous Endings, which were left at the *Sternum*; where thrusting in your Fingers between that Membrane and the internal *Intercostal Muscles*, you may clear it away to the *Vertebrae* of the Back. By which means you will have a clear View of the Series of Fibres of those Muscles.

LXXIX.

INTERCOSTALES INTERNI.

Tab. III.
XXXIII.

ARE in number eleven on each side, arising from the upper edge of each inferior Rib, and inserted into the lower edge of that immediately above it, the Course of their Fibres ascending obliquely forwards. But we have observ'd, that some Parts of these Muscles lying next the *Vertebrae*, pass over the Rib immediately above their Origine, and are inserted into the next, as represented in Tab. XXXIII. Fig. II. *AB, AB*.

THESE seem to depress the Ribs.

LXXX.

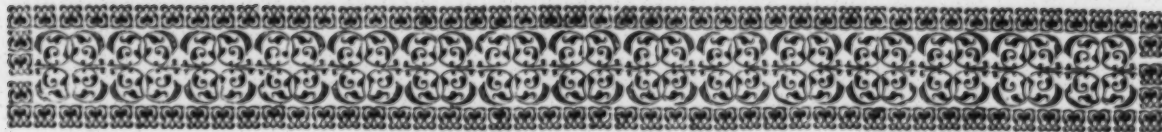
C O R.

Tab. XXXVI.
XXXVII.
XXXVIII.
XXXIX.
XL.

WE have been so large in the Representation of the several Parts of this Muscle in five Copper Plates, and in the Description of them in the References thereto belonging, that we think it superfluous to say any more of it in this Place.

N. B. To prosecute our Work, we must now lay the Subject in a prone Position the Back uppermost, continuing our Section from the Occiput down to the Os Sacrum, and intersecting it with a transverse Line over the Regio Lumbalis. Which done, and the common Integuments removed, the subjacent Muscles may be best dissected in the following Order.





CHAP. XX.

Of the MUSCLES of the SCAPULA, or SHOULDER-BLADE.

Tab. VII.
XLII.

THESE Muscles make the second Division of those relating to the Motion of the *Thorax*, as above-said.

LXXXI.

CUCULLARIS, seu TRAPEZIUS.

SO named, because this with its Fellow covering the Back represents a Cowl. It arises fleshy from the *Os Occipitis*, tendinous from the *Ligamentum Colli*, and *Apex* of the Spine of the last *Vertebra* of the Neck, and eight superiour of the *Thorax*; from which broad Origination becoming thick and fleshy, it's so inserted into the *Clavicula*, but is mostly tendinous at its Insertion into the *Spina Scapulae*. Each Muscle is triangular, and both jointly compose a Lozenge or *Trapezium*, whose large Diameter extends from the *Occiput* to the fifteenth *Vertebra*; the shorter from near the Extremity of the *Spina Scapulae* on one side to that of the other. They contain a triple Series of Fibres; the middle passing directly transverse from the first *Vertebra* of the *Thorax*; those above descend, and those beneath ascend to their Insertion; whereby the *Scapula* is variously moved according to their Directions, either obliquely upward, directly back, or obliquely downwards.

N. B. You must proceed with Caution in the separation of this Muscle, lest you raise the following with it, which adheres very strictly to its tendinous Part, where it springs from the superiour Spines of the *Vertebrae Thoracis*.

LXXXII.

RHOMBOIDES.

XLI. XLII.

SO called from its Figure. This lies immediately under the former: In some Subjects we have found it divided into two distinct Muscles on each side. It arises tendinous from the *Ligamentum Colli*, the Spines of the lowest *Vertebra* of the

the Neck, and four uppermost of the *Thorax*; whence descending obliquely, it becomes thick and fleshy, and is so inserted into that part of the *Basis Scapulæ* that lies below its Spine.

WHEN this acts, it draws the *Scapula* upwards and backwards.

N. B. THIS adheres strictly to its subjacent Muscle the *Serratus Superior Posticus*; wherefore you must be cautious in raising it.

LXXXIII.

LEVATOR SCAPULÆ.

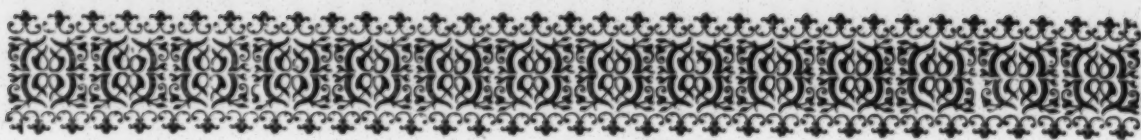
Ibid.

BY some called *Levator Patientiæ*. This lies immediately under the *Cucullaris*, arising by so many separate Originations from the first, second, third, and fourth transverse Processes of the *Vertebrae* of the Neck. These unite into one large fleshy Body, which descends obliquely to its Insertion into the superiour Angle and the next part of the *Basis* of the *Scapula*.

WE have found in some Subjects a few Slips of fleshy Fibres sent off from this Muscle at its lower Part, and ending tendinous on the second, or third Rib, with the upper Part of the *Serratus Major Anticus*.

ITS Name declares its Office.

N. B. WE proceed next to the Muscles of the *Thorax* which appear on the Back-side, the Body lying prone; to discover which, the *Latissimus Dorsi* must be removed, part of it being raised in the *Ilium* in dissecting the Muscles of the *Abdomen*, where you must pursue its Separation, first cutting it from the posteriour Part of the Spine of the *Ilium*, separating it (if possible) from the *Serratus Inferior Posticus*; freeing it from the Spines of the *Loins*, and inferiour of the *Thorax*, and leaving it at its Insertion into the *Os Humeri*. This done on both sides, the rest of the Muscles of *Respiration* offer themselves.



CHAP. XXI.

Of the MUSCLES of the THORAX, which appear on the backside of the Body.

Tab. XLI.
XLII.

THESE constitute the third Order of Muscles belonging to the Thorax.

LXXXIV.

SERRATUS SUPERIOR POSTICUS.

THIS lies immediately under the *Rhomboides*, as above noted. It arises with a thin Tendon from the *Ligamentum Colli* the Spine of the lowest *Vertebra* of the Neck, and three superiour of the *Thorax*; from thence descending obliquely over the *Splenius Capitis*, and upper Parts of the *Sacro-lumbalis*, and *Dorsi Longissimus*, it becomes fleshy, marching under the *Scapula* to its Insertion at the Curvature of the second, third, fourth, fifth, and sometimes sixth Ribs, by so many distinct fleshy Endings.

THIS assists in elevating the Ribs.

LXXXV.

Ibid.

SERRATUS INFERIOR POSTICUS.

THE Origination of this Muscle is much larger than Authors generally assign it. In a robust Subject we observed its Continuation not only from the Spines of the *Vertebrae* of the Loins, but from all those of the *Thorax*, as well underneath as below the former Muscle; its superiour and inferiour Parts being entirely tendinous, its middle growing fleshy near its serrated Terminations at the Curvature of the tenth, eleventh, and Extremity of the twelfth Ribs. The *Ductus* of Fibres of this passing transverse, and those of the precedent descending obliquely, do decussate each other in acute Angles; which * *Riolan* has well observed, and

* *Anthrop. Lib. 5.*

contrary to the Opinion of other Authors, assigns this Muscle with its Partner a different Use, in depressing the *Thorax*; both performing the Office of a Bandage in binding together and constringing the posteriour Muscles of the Spine, not unlike those constrictive Inclosures of the Thigh and Cubit hereafter mentioned.

LXXXVI.

SACROLUMBALIS.

Tab. VIII.
IX. XLV.

THIS rises in common with the *Longissimus Dorsi*, externally tendinous, and internally fleshy, from the hinder part of the Spine of the *Os Ilium*, the upper Part of the *Sacrum*, and all the Spines of the *Vertebrae* of the Loins. Whence ascending with a direct Order of Fibres, they are inserted, by several common Terminations, into the transverse Processes of the *Vertebrae* of the Loins, before their Division into two separate fleshy Bodies, at their Passage over the lowermost Rib; the outermost of which is called *Sacrolumbalis*. This is inserted into the twelve Ribs, near the beginning of their Curvature, by so many thin, long Tendons. It receives a *Fasciculus* of tendinous and fleshy Fibres from each of the nine, or ten, lower Ribs; which after their uniting with the Body of the Muscle, are continued to the Tendons above-mention'd, that are inserted into the upper Ribs. These *Fasciculi* are call'd by *Steno**, *Musculi ad Sacrolumbum accessorii*. The upper Part of this Muscle, after it has past the *Thorax*, is inserted by four Tendons into the third, fourth, fifth, and sixth *Vertebrae* of the Neck; which Part is by *Diemerbroek* † made a distinct Muscle, and called *Cervicalis Descendens*.

LXXXVII.

INTERCOSTALES EXTERNI.

Tab. XLIV.
XLVI.

ARE equal in number to the Internal. They arise from the lower Edges of the upper Ribs, and descending obliquely forwards are inserted into the upper Edge of the Rib next below, their Fibres decussating those of the internal Intercostals. The *Levatores Costarum*, arising from the transverse Processes of the *Vertebrae* of the Back, and inserted into the upper Edge of each Rib, except the first, we esteem as parts of these external Intercostals.

Now all the Muscles of the Head may be examined.

* *Specim. Myolog.* † *Lib. 5. Cap. 6.*



CHAP. XXII. Of the MUSCLES of the HEAD.



THE Head is moved by Muscles that are either *Common* or *Proper*.

THE *Common* are those, which move the Head together with the *Vertebrae* of the Neck, which shall be described in the following Chapter, under the Title of *the Muscles of the Neck*.

THE *Proper* are those, which move the Head together with the first *Vertebra* of the Neck only, the rest remaining unmoved; of which latter Anatomists,

as * *Spigelius*, † *Veslingius*, and others reckon eight pair, viz. *Mastoidei*, *Splenii*, *Complexi*, *Par tertium Falloppii*, *Recti Majores*, *Recti Minores*, *Obliqui Superiores* & *Obliqui Inferiores*: But ‡ *Oribasius* adds two pair more, who is followed by ** *Falloppius*, which shall be described here, as they arise in Dissection, together with another pair of Muscles, not mentioned by any Author, (for what I know,) but first observed by me some time since.

* *Lib. 4.*

† *Cap. 12.*

‡ *Lib. De Diffet. Muscul. ex Galeno, Cap. 10.*

** *Observ. Anatom.*

LXXXVIII.

SPLENIUS.

Tab. XII.
XLIII.

ARISETH partly tendinous and partly fleshy, from the four superiour Spines of the *Vertebrae* of the *Thorax*; and this lower Part seems to be distinct from the upper, which ariseth from the Spines of the two inferiour *Vertebrae* of the Neck only. The lower Part ascending obliquely grows fleshy, and becomes tendinous again at its Insertion into the first, second, and some times third, transverse Processes of the *Vertebrae* of the Neck: The upper part of the Muscle in like manner ascending obliquely outward, grows fleshy, and is so inserted into the *Occiput*, partly under the Implantation of the *Mastoides*. Although this Muscle by Anatomists be reckoned amongst the proper Muscles of the Head, yet when it acteth it must necessarily move the first, and second *Vertebrae* of the Neck (into which it is inserted) obliquely backwards; but acting with its Partner, it pulleth those *Vertebrae* together with the Head directly backwards.

LXXXIX.

COMPLEXUS.

Tab. IX.
XLIII.

RISES fleshy from the transverse Processes of the six upper *Vertebrae* of the *Thorax*, partly tendinous and partly fleshy from those of the six lower *Vertebrae* of the Neck; after which becoming fleshy, and partly tendinous on the outside, it is inserted broad and fleshy into the *Os Occipitis*. That part of this Muscle, that springs from the transverse Processes of the *Thorax*, joins with the *Longissimus Dorsi*. The Fibres of this Muscle are rightly observed to decussate those of the former. *Falloppius* makes a part of the *Longissimus Dorsi*, that passes over the *Complexus*, a distinct Muscle, which he calls the third Muscle of the Head. This is more distinct in some Bodies, than in others.

EITHER of the *Complexi* acting moves the Head backwards to one side: If both act together, they assist the two former. This with its Partner being raised, the four following Muscles appear underneath.

XC.

RECTUS MAJOR.

Tab. VI.
Fig. IV.
Tab. XLIII.

THIS ariseth partly tendinous, but chiefly fleshy from the superiour part of the double Spine of the second *Vertebra* of the Neck, and in its ascent becomes broader and fleshy, and is so inserted into the hinder part of the *Os Occipitis*, partly under the Termination of the *Obliquus Superior*.

THIS Muscle with its Partner acting, pull the Head directly back on the first *Vertebra*. These being both raised, the following Muscle will appear underneath.

XCI.

RECTUS MINOR.

Ibid. and
Tab. XLIV.
M.

THESE are two small Muscles, appearing in some Subjects before the former are dissected. They arise fleshy from the posteriour part of the first *Vertebra* of the Neck, and are so inserted into the middle part of the *Os Occipitis*, in two shallow Depressions of the said Bone.

THESE from their Use may be called *Renuentes*, or Nodders backwards, and are Antagonists to those we shall hereafter describe, and call *Annuentes*.

XCII.

OBLIQUUS SUPERIOR.

Ibid.

THIS arising fleshy from the back part of the transverse Process of the first *Vertebra* of the Neck, in its somewhat oblique Ascent becometh a fleshy Belly, and lessening it self again, is inserted into the *Os Occipitis* laterally.

By this, together with its Partner, (they never acting separately) the Head is moved backwards on the first *Vertebra*.

XCIII.

OBLIQUUS INFERIOR.

Ibid.

THIS ariseth fleshy from the external part of the Spinal Process of the second *Vertebra* of the Neck, close by the Origination of the *Rectus Major*, and being dilated into a fleshy Belly, passes obliquely to its Insertion at the transverse Process of the first *Vertebra*, where the former Muscle begins. When this acts on either side the transverse Process of the first *Vertebra* of the Neck is moved towards the Spine of the second; wherefore some Authors have reckoned it amongst the Muscles of the Neck. But since the Head is also moved thereby, and the Face turned to that side on which it acteth, it is not improperly reckoned amongst the Muscles that move the Head. It is assisted by the *Mastoides*; of which in its Order.

THE

Of the MUSCLES of the HEAD.

63

THE four Muscles last treated of are named from their Progress, Position, and Magnitude.

THE Body must now be turned on the Back again, to examine the rest of the Muscles of the Head that appear on the fore part, together with those of the Neck, of which the first is the Mastoideus, which is best raised, by freeing it at its Origination on one side, and its Insertion on the other, as in Chap. XII. in order to dissect the Muscles of the Os Hyoides and the Tongue.

XCIV.

MASTOIDEUS.

Tab. VXXII.
XLIII.

SO called, because it is inserted into the Mamillary Process of the Temple-Bone. It ariseth partly tendinous, and partly fleshy, from the upper part of the Os Pectoris, and near half the Clavicle, with two (as it were) distinct Originations; the first of which ascending somewhat obliquely outwards joins with the second, and afterwards marches up more directly, composing a round, thick, fleshy Body, which, as it passeth over the upper part of the Musculus Levator Scapulae, becomes broader and tendinous, and is so inserted into the back part of the Processus Mamillaris, and the adjoining part of the Os Occipitis, where the Splenius (above treated of) is implanted.

THESE Muscles contracting together bend the Head forwards; but either of them acting alone draws it down to one Side.

THE next Muscle that presents it self to the Knife, is partly described by * Galen, and mentioned by † Vesalius as belonging to the Back: ‡ Fallopius makes it his ninth Pair of the Head. It is also mentioned by Riolan, Casp. Baubin, Bartholomæus Eustachius, and others. Tho' it be a large fleshy Muscle, and appear immediately under the Gula or Pharynx, yet Spigelius and some others take no notice of it. It is likewise express'd by Bidloo, and called Rectus Internus. But we having observed an other small pair of Muscles underneath this pair, of a right Position likewise, we shall call them, for distinction, Recti Interni Minores, and these, Recti Interni Majores.

XCV.

RECTUS INTERNUS MAJOR.

Tab. III.
XLIII.

THIS has commonly four Beginnings, partly tendinous, but chiefly fleshy, from the fore part of the four lowermost transverse Processes of the Vertebrae of the Neck; (but in some Subjects we have found its Origination to extend much lower down, even as far as the fourth Vertebra of the Thorax,) and in its

* Lib. de Musculis.

† Lib. 2. cap. 28.

‡ Observ. Anatom.

ascend becoming fleshy, passes over the three superiour *Vertebrae*, and is inserted into the anterior *Appendix* of the *Os Occipitis*, near the great *Foramen*, that transmits the *Medulla Oblongata*.

THIS manifestly bends the Head forwards, and therefore may be called *Flexor Capitis* from its Use.

THIS with its Partner being removed, the following pair of Muscles appear underneath them.

XCVI.

RECTUS INTERNUS MINOR.

Tab. XXIV.
XLIII.

THIS and its Partner appear on the fore part of the first *Vertebra*, like the *Recti Minores* on the back part, arising near its transverse Processes, whence they ascend directly, and are inserted into the anterior *Appendix* of the *Os Occipitis*, immediately under the former.

THESE nod the Head forward, and are Antagonists to the *Recti Minores*, as is above noted, wherefore they may be called *Annuentes*.

THE last pair of Muscles which we shall treat of belonging to the Head, are mentioned by *Galen*, and described by * *Falloppius* in these Words; *Ultimo loco notandi sunt Musculi duo admodum parvi, qui à Processu transverso Primæ Vertebrae orti, valde graciles ascendunt ad Caput, & in illud inseruntur prope Mamillarem processum.* These we shall call *Recti Laterales*, from their Progress and Position; they may be also called *Reuuentes Laterales* from their Use.

XCVII.

RECTUS LATERALIS.

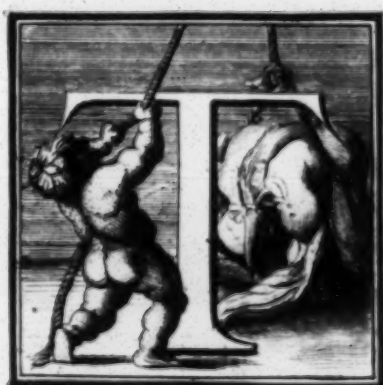
Ibid. and
Tab. XLIV.
N.

THIS is a short, thick, fleshy Muscle; arising from the superiour part of the Extremity of the transverse Process of the first *Vertebra* of the Neck, between the former and *Obliquus Superior*, whence it ascends directly to its Insertion into the *Os Occipitis*, in the Interstice made by the *Processus Mamillaris* and *Styloides*. This nods the Head to one Side.

* *Observat. Anatom.*



CHAP. XXIII.
Of the MUSCLES of the NECK.



THE Muscles of the Neck move the Head secondarily, whence they are esteemed as *Common* to both. Of these Authors reckon four pair, namely the *Longi Colli*, the *Scaleni*, (which according to *Fallopius* are described amongst the Muscles of the *Thorax*) the *Transversales*, and *Spinati Colli*.

XCVIII.
LONGUS COLLI.

Tab. III.
XLIV.

THIS arises partly tendinous, but chiefly fleshy from the fore part of the three superiour *Vertebrae* of the *Thorax*, and three lowermost of the Neck; and being dilated in its middle to a fleshy Belly, is inserted into the fore part of all the rest of the *Vertebrae* of the Neck.

THIS with its Partner acting bends the Neck right forwards. Between this and the *Scaleni*, (describ'd Chap. XIX.) lies the *Rectus Internus Major*, describ'd in the precedent Chapter, which **Veslingius* calls *Musculus Brevior*.

XCIX.
SPINALIS COLLI.

Tab. XLIV.

SO called, because it accompanies the Spines of the Neck. It arises tendinous and fleshy from the transverse Processes of the five upper *Vertebrae* of the *Thorax*, and the lowermost of the Neck. In its Ascent it becomes more fleshy, and has a large fleshy Insertion into the inferiour part of the second *Vertebra* of the Neck laterally, near its Spinal Process. Internally it sends off three Tendons, which terminate in the Sides of the double Spines of the third, fourth, and fifth *Vertebrae* of the Neck.

THESE draw the Neck backwards; or a little to one Side, when they act separately.

C.

INTERSPINALES COLLI.

Tab. XLIV.
XLVI.

THESE are small fleshy Muscles, arising from the superiour Part of each double Spinal Process of the Neck, except that of the second *Vertebra*, and are inserted into the inferiour part of the double Spines immediately above them.

WHEN these Muscles act, they draw the Spines of the *Vertebra* of the Neck nearer each other. These we first discover'd in the Year 1690.

CI.

TRANSVERSALIS COLLI.

Tab. XLV.
XLVI.

THIS ariseth fleshy from all the transverse Processes of the *Vertebra* of the Neck, except the first and second, and is inserted, after an oblique ascending Progress, into their superiour Spines: It being a Continuation of the same Series of Muscular *Fibres* that compose the *Sacer* and *Semi-Spinatus*; of which hereafter.

THIS Muscle detaches off two several Productions, the shorter of which is inserted into the *Os Occipitale*, near the Mastoide Process; the longer and slenderer is likewise implanted in the *Os Occipitis*, beside the Production of the *Longissimus Dorsi*, called, *Par tertium Falloppii*.

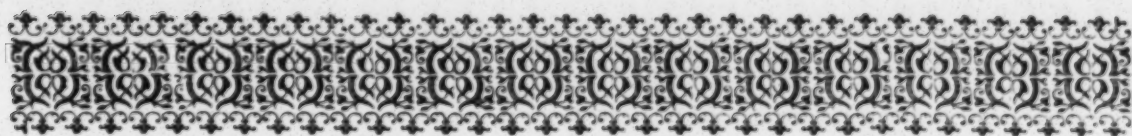
THIS pair of Muscles acting together, help to keep the Neck erect; but either of them acting alone, draws the *Vertebra* of the Neck obliquely backward, by which Motion the Head is turned towards the contrary Shoulder.

Tab. XXIII.
XLIV.

THE *Intertransversales* are small Muscles, arising from each transverse Process of the *Vertebra* of the Neck, except the first, and inserted into the transverse Process immediately above.



CHAP.



CHAP. XXIV.

Of the MUSCLES of the BACK and LOINS.



It would be very tedious and of little Use to insert all the different Accounts Anatomists have given us of these Muscles; and the variety we have found in several Subjects, inclines us to think, that scarcely three in ten are exactly alike in this respect. Which Irregularity might perhaps induce *Fallopius* to that ingenuous Confession, that these Muscles seemed to him to be an indigested Heap and confused *Chaos*. However, we shall endeavour to give as distinct an

Account of them as possible; and in order thereunto, we shall consider them as *Common* to the Back and Loins, or *Proper* to either of them.

THE *Common* are such as arise from the one, and are inserted into the other, as the *Dorsi Longissimi*.

THE *Proper* are either such, as arise from the *Os Sacrum* or *Ilium*, and are inserted into the *Vertebrae* of the Loins only, as the *Quadrati Lumborum*; or arise from the transverse Processes either of the *Vertebrae* of the Loins or *Thorax*, and are inserted into their superiour Spines; as the *Transversales Vertebrarum Dorsi & Lumborum*, which by Authors are commonly called *Sacer* and *Semispinatus*.

CII.

LONGISSIMUS DORSI.

Tab. VIII.
IX. XLV.

THIS Muscle takes its Origine in common with the *Sacrolumbalis*, from the back part of the Spine of the *Os Ilium*, the upper part of the *Sacrum*, and the Spines of the *Vertebrae* of the Loins; and in its ascent is inserted with it into the transverse Processes of the *Vertebrae* of the Loins, as before noted, Chap. XXI. After their Division upon the last Rib, the inner Muscle next the Spine takes the Name of *Longissimus Dorsi*, ascending with a partly fleshy, and partly tendinous outside, and Fibres passing somewhat obliquely outward. Part of these tendinous Fibres arise distinct from the lower Spines of the *Vertebrae* of the *Thorax*, and the uppermost of the Loins; from which Tendons do likewise arise some fleshy Fibres, which ascending obliquely inwards, are afterwards inserted into the fifth, sixth, and seventh

seventh Spine of the *Thorax*. This Part is by some improperly call'd *Semispinalis*. The other larger Part of this Muscle, ascending on the *Thorax*, divides it self into many distinct Portions, not much unlike a Palm Branch, which are inserted into the transverse Process of each *Vertebra* of the *Thorax*, into each Rib near its Tubercle, and into the three lower transverse Processes of the *Vertebrae* of the Neck; whilst a long fleshy Production of it ascends over the rest of the transverse Processes of the Neck, to its Insertion into the *Os Occipitis*, behind the *Processus Mastoideus*.

Tab. XLV.
F.
Tab. XXIII.
102.

WHEN this and its Partner act in conjunction with the *Sacrolumbalis*, they are not only serviceable in keeping the Trunk of the Body erect and bending it backwards, but likewise in Progression. For it may be observed, that when either Leg is moved forwards, these Muscles on the same Side are in action; which to us seemeth to be advantageous for the more commodious Elevation of the Thigh, by rendering the *Os Ilium* and the *Vertebrae* of the Loins at that time stable; from which Bones the Benders of the Thigh take their Origine.

N. B. To examine this Muscle, it is best to use the Fingers, or the pointed Handle of a dissecting Knife, to divide it from its Companion, the *Sacrolumbalis*, and discover its Ansulæ, as Spigelius calls those Parts of it, which are inserted into the transverse Processes of the *Vertebrae* of the Back and Loins.

CIII.

QUADRATUS LUMBORUM.

Tab. XLIV.
XLVI.

ARISES fleshy from the posteriour part of the Spine of the *Os Ilium*, whence it ascends obliquely with various Orders of fleshy Fibres, and is inserted into all the transverse Processes of the *Vertebrae* of the Loins internally, under the *Psoas* Muscle, as likewise into the lower Edges of the two last Ribs. This, like the *Musculus Rectus Abdominis*, either draws the *Vertebrae* of the Loins nearer the *Os Ilium* laterally, when we are standing on both Legs, or else brings the *Os Ilium* nearer the said *Vertebrae*, when we stand upon the opposite Leg only.

CIV.

SEMISPINATUS.

Tab. XLV.
XLVI.

THIS might not improperly be call'd the *Transversalis Dorsi*. It ariseth fleshy from all the transverse Processes of the *Vertebrae* of the *Thorax*, and marching obliquely upwards is inserted into the superiour Spines of the said *Vertebrae*. This with the following Muscle and *Transversalis Colli* acting together on one side, move the whole Spine, or *Vertebrae* of the Neck, Back, and Loins, obliquely backwards, as when we endeavour to look behind us: If they all act together on both Sides, they assist in erecting the Trunk of the Body.

CV.

SACR.

Ibid.

THIS may be also called *Transversalis Lumborum*. It lies under the tendinous part of the *Longissimus* above-mentioned, arising fleshy from the *Os Sacrum*, and the transverse Processes of all the *Vertebrae* of the Loins, and is inserted into their superiour Spines. We have sometimes observed a *Spinalis Lumborum*, like the *Spinalis Colli* above described, which arising from the superiour Spines of the *Os Sacrum*, and marching with direct fleshy Fibres, is so inserted into the Spines of the upper *Vertebrae* of the Loins; the *Transversalis Lumborum*, now described, lying under it.

CVI.

MUSCULUS COCCYGIS.

*Tab. IX.
XLV.*

ARISES narrow, partly fleshy and partly tendinous, from the acute Process of the *Os Ischium*, and dilating it self into a broad thin Belly, is inserted laterally along the whole *Os Coccygis*.

WE need not wonder at the many *Multiform* Muscles inservient to the Extension or Erection of the Head, Neck, Back and Loins, if we consider how great a force is required to sustain the Head and *Thorax*, on account of their projecting so much forwards from the *Vertebrae*. For if we take a view of the Skeleton, *Tab. VI.* we should think the Body constantly liable to fall on its Face, were it not supported by these many strong Muscles. In which we have a plain Demonstration of the immense Wisdom of the most wise Architect, in framing a Structure projecting from its *Fulcimen*, which for several Ends (too numerous to specify here) is to be moved forwards, backwards, and sideways, and could by no other means be supported so, as to render it upon occasion flexible, but by Muscles; they being capable of a much greater Contraction and Relaxation, than any other springy Bodies, composed of Ligaments, &c.

THUS having briefly treated of all those Muscles, as yet known, that appear on the Trunk of the Body, we come next to those belonging to the Limbs, and first to those that move the Arm; two of which, namely, the *Pectoralis* and *Latissimus*, we were obliged to dissect before, to discover the subjacent Muscles; but we shall now describe them among the rest, as the order of Dissection requires. For the more convenient Administration of these Muscles, we are wont to take of the whole Arm, together with the Scapula and Clavicula, by dividing the latter from the *Os Pectoris*, by which means the trouble in examining them is lessened, those moving the Scapula being cut from it.



CHAP. XXV.

Of the MUSCLES of the ARM, or Os HUMERI.



ALLEN*, Jacobus Sylvius†, and Vesalius‡, describe seven Muscles belonging to each Arm, viz. *Pectoralis*, *Deltoides*, *Teres Major*, *Latissimus Dorsi*, *Supraspinatus*, *Infraspinatus*, and *Subscapularis*. *Aranzius*, in his Anatomical Observations, counts another by ** *Riolan* called *Coracobrachieus*, to which †† *Julius Cafferius Placentinus* adds the *Teres Minor*, by some reckoned as the eighth Muscle of this part, which is therefore called *Octavus Humeri Placentini*. Of these in their Order.

CVII.

PECTORALIS.

SO called from its Situation. This hath a broad, semicircular, fleshy Beginning, above, from near half the inferiour part of the *Clavicula*, below, from the *Os Pectoris*, and all the cartilaginous Endings of the six superiour Ribs; and from the Bony Part of the seventh it hath a distinct *Fasciculus* of fleshy Fibres, which

Tab. I.
XLVII.

* Cap 18. † *Isagog. Anatom.* ‡ *Lib. 2. Cap. 24.* ** *Lib. 5. Cap. 24.*
†† *Tab. 17. Lib. 4. Spigelii.*

sometimes

Sometimes we have seen confounded with the *Obliquus Descendens Abdominis*. From this large Origine it marcheth transversly, and becoming narrower but thicker, lessens it self as it passeth over the upper part of the *Biceps Cubiti*, and is inserted by a short, but broad strong Tendon, into the superiour part of the *Os Humeri*, from immediately above the Termination of the following Muscle, to the smooth Head of the Bone, where it joins with part of the *Ligamentum Latum* of the *Humerus*, which Ligament is connected with the *Ligamentum Fasciale* of the *Musculus Infra-spinatus*, *Teres Minor*, and *Major*.

The Fibres of this Muscle decussate each other, near their Implantation into the *Os Humeri*; those of the superiour part running downwards, and those of the inferiour marching up, and intersecting the former in acute Angles.

WHEN this Muscle acts, it moves the Arm obliquely upwards, directly forwards, or obliquely downwards; according to the various Direction of its *Series of Fibres*.

CVIII.

DELTOIDES.

Tab. XLVII.
XLIX.

SO called from its Figure, being like the Greek Δ . It hath a broad Origination, forwards from above one third of the inferiour and external part of the *Clavicula*, where it is entirely fleshy; backwards it springeth partly fleshy, but chiefly tendinous, from the whole inferiour Margin of the *Spina Scapulae*. In its descent from this Origine, it soon becomes thick and fleshy, growing narrower, till it is inserted by its partly fleshy, and partly tendinous *Apex*, into the middle of the *Os Humeri*. This draws the Arm either directly upwards, or somewhat forwards, or backwards, according to the Direction of its differing *Series of Fibres*.

CIX.

SUPRASPINATUS.

Tab. VIII.
XLI. XLVII.

SO called, because it is placed above the Spine of the Shoulder-Blade. It ariseth fleshy from that part of the *Basis Scapulae*, that is above its Spine, as also from the said Spine, and *Costa Superior* of the *Scapula*; from whence passing between the *Processus Coracoides*, and *Anchoriformis*, it grows less, and becoming tendinous, marches over the Articulation of the *Humerus*, joining its Tendons with the following, and is inserted into the Head of the *Os Humeri*. The proper Use of this Muscle is to lift the Arm upwards towards the *Occiput*.

CX.

Tab. XLI.
XLVII.

INFRASPINATUS.

SO called because it lies below the Spine. This arises fleshy from the inferior part of the *Basis Scapulae*, as also from its Spine, its inferior *Costa* and *Dorsum*; from hence passing in a triangular Form according to the Figure of the Part, and lessening it self as it marches over the Juncture, it becomes tendinous, and is inserted like the former into the Head of the *Os Humeri*. This moves the Arm directly backwards.

CXI.

Ibid.

TERES MINOR.

SO called from its Figure and Magnitude, to distinguish it from the following.

THIS Muscle in some Bodies cannot be distinguished from the former, but in others we have found it distinct enough.

It arises fleshy from the lower part of the inferior *Costa* of the *Scapula*, and descends obliquely over the superior Head of the *Gemellus*, where becoming tendinous, it is inserted into the Head of the *Os Humeri*.

WHEN this acteth, the Arm is moved backwards.

CXII.

Tab. XLI.
XLVIII.
XLIX.

TERES MAJOR.

THIS arises from the inferior Angle of the *Scapula*, and becoming a round fleshy Body, ascends obliquely below the former, and passes under the superior Head of the *Gemellus*, where it becomes a short, flat Tendon, inserted below the Neck of the *Os Humeri*, close to that of the following.

THIS draws the Arm backwards, and somewhat downwards.

CXIII.

Tab. VII.
XLVIII.LATISSIMUS DORSI, *five* ANISCALPTOR.

THE first Appellation it receives from its large Dimensions, the whole Back being cover'd with it and its Partner; the latter from the use, that is sometimes made of it. Its thin, broad, tendinous Origination, is continued from the seven inferior Spines of the *Vertebrae* of the *Thorax*, all those of the Loins, the upper ones of the *Os Sacrum*, and the back part of the Spine of the *Os Ilium*; it begins to grow fleshy, as it passes over the *Longissimus Dorsi* and *Sacrolumbus*; and in its Progress over the curved part of the Ribs it receives several *Fasciculi* of fleshy Fibres arising from them in several Fissures of the *Obliquus Descendens*, which by

by their Conjunction compose a thick Body, still lessening it self in its Dimensions, as it marcheth towards the *Axilla*, and running over the inferiour Angle of the *Scapula*, from which sometimes does arise a fleshy part of it, which I have observed in those Bodies in which the *Teres Minor* was absent, being at last inserted by a short, but flat, strong Tendon, into the *Os Humeri* near the former.

THE next Muscle that presents it self, is the *Coracobrachialis*, by some called *Perforatus*, which is described by *Galen* and *Vesalius*, as part of the internal Head of the *Biceps Cubiti*.

CXIV.

CORACOBRACHIALIS.

Tab. XLVIII.
XLIX.

SO called from its Origination and Insertion. It arises partly fleshy, and partly tendinous, from the Extremity of the *Processus Coracoides Scapulae*, and in its descent it becomes larger, strictly adhering to the internal tendinous Beginning of the *Biceps*, and parts from it near its partly tendinous and partly fleshy Insertion at the middle of the internal part of the *Os Humeri*. Through this Muscle passeth a large Nerve; wherefore by some it is called *Perforatus*.

WHEN it acts, the Arm is moved upwards, and turned somewhat obliquely outward.

CXV.

SUBSCAPULARIS.

Ibid.

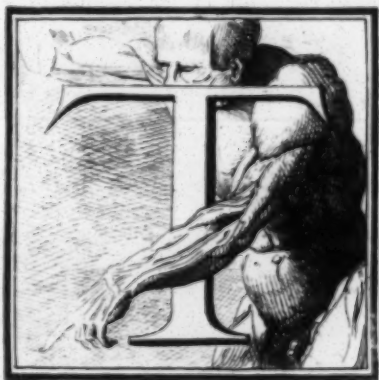
SO named from its Situation, by some called *Immersus*. It is a large fleshy Muscle, filling the internal Concave part of the *Scapula*, arising fleshy from its whole *Basis* and *Superior* and *Inferior Costa* internally; as it marches forward, it lessens it self according to the Dimensions of the Bone, and passing over the Juncture, is inserted in a semicircular Manner into the Neck of the *Os Humeri*.

THIS Muscle draws the *Os Humeri* down close to the Ribs. Its Tendon together with those of the *Supraspinatus*, *Infraspinatus*, and *Teres Minor*, unite near their Insertions, and join with the broad Ligament of the Articulation of the *Os Humeri* with the *Scapula*.

IN moving the Arm circularly, these last named Muscles act successively.



CHAP. XXVI.
Of the MUSCLES of the CUBIT.



Tab. XLIX.
L.

THE lower part of the Arm from the Elbow to the Wrist is called the *Cubit*, which is bended and extended by five Muscles, namely, *Biceps*, *Brachæus Internus*, *Gemellus*, *Brachæus Externus*, and *Anconæus*.

CXVI.
BICEPS.

HATH two Heads or Beginnings; the first or outermost of which arises with a long round Tendon from the upper part of the Brink of the *Acetabulum Scapulae*, and runs under the Ligament of the Articulation, in a *Sulcus* or Chanel on the Head of the Shoulder-Bone, wherein it is inclosed by a proper Ligament. In its Descent it begins to grow fleshy, as it marcheth under the Termination of the Pectoral Muscle, where dilating it self into a large fleshy Body, it joins with the internal Head or Beginning. This ariseth with a somewhat broad, flat, and long Tendon at the Extremity of the *Processus Coracoïdes Scapulae*; in its descent it strictly adheres to the *Coracobrachialis*; on which account some Authors, not rightly describing that Muscle amongst those of the Arm, have mistaken it for a fleshy Beginning of this. But then parting from it, both these Heads compose a large fleshy Belly, which becoming tendinous near the *Cubit*, is commonly said to be inserted by a strong, round Tendon, into the Tubercle near the upper Head of the *Radius*. But we have observed this Tendon to be double, the External Part of which being thin, passeth obliquely over the *Musculus Pronator Radii Teres*, and Membrane-like expanding it self, joins with the *Membrana Communis Musculorum*, which embraceth all the external Muscles of the *Carpus* and Fingers.

WHEN this Muscle acts, the *Cubit* is bended.

THE double tendinous Termination of this Muscle, (tho' not taken notice of by any Author, that we know) is very evident, and was observ'd first by us some Years since, in dissecting these Muscles, in Company with our very good Friend, that most indefatigable and curious Botanist Mr. *Samuel Doody*. It appeareth immediately under the Skin and *Membrana Adiposa* of the *Cubit*.

THIS

THIS external Tendon, which we call *Fascia Tendinosa*, seems not to be designed only for the more advantageous elevation, or bending of the *Cubit*, which it more easily moves, by how much the more it recedes from the centre of its Motion or *Fulcrum* at the lower part of the Arm-Bone. For as it strictly includes all the external Muscles, whether belonging to the *Radius*, *Carpus*, or Fingers, it thereby corroborates them in performing those strenuous Actions they are necessarily employ'd in. This latter Use was first suggested to us, by observing those artificial Bandages made of Leather, which some laborious Mechanicks make use of, adapting them to the belly'd part of the Muscles of the *Cubit*; amongst which Turners, and especially those that use the Rasp, in making the Frames for Cane-Chairs, (as they are commonly called) like a double Screw, are frequently obliged to this Artifice.

IN *Plebotomy* the *Ductus* of these external tendinous Fibres ought to be respected, by directing the Launcet according to their Length, to avoid too great a division of them, which is frequently the occasion of those ill Symptoms, that remain after that so commonly practised Operation by bold Blood-Letters.

AN extraordinary Case, relating to this Muscle, has more than once happened in our Practice. Particularly a Woman, three days before she consulted us, had, (as she suspected) dislocated her Shoulder-Bone, by wringing of Linen Clothes after washing, (which is commonly done to express the Water) adding, that in straining her Arm, in that Action, she sensibly felt something (as she thought) slip out of its place on her Shoulder. After examining the Part, we were well satisfy'd that there was no Dislocation: But observing a Depressure on the external part of the *Deltoide* Muscle, and finding the two inferiour Tendons of this *Bicipital* Muscle rigid, and the *Cubit* thereby denied its due Extension, we suspected that the external tendinous Beginning, (before taken notice of) was slipt out of its Chanel on the Head of the *Os Humeri*; but finding the part at that time somewhat inflamed, we advis'd her to an emollient Application, and to give her Arm rest till the next Day, at which time we found our Conjecture true; for by turning the whole Arm to and fro, the Tendon readily slipt into its place, she recovering the Use of the Part immediately.

CXVII.

BRACHIÆUS INTERNUS.

Ibid.

THIS derives its Name from its Situation, lying partly under the former. It arises fleshy from the internal part of the *Os Humeri*, at the Insertion of the *Deltoides* and *Coracobrachialis* Muscles, and descending over the Juncture of the *Cubit* with the Arm-Bone, it's inserted partly fleshy and partly tendinous into the superiour and fore part of the *Ulna*. This is also a Bender of the *Cubit*.

CXVIII.

CXVIII.

Ibid.

GEMELLUS.

SO called from its double Origine. It ariseth first tendinous from the upper part of the inferiour *Costa* of the *Scapula* internally, and as it passeth between the two round Muscles it grows fleshy, and in its Descent joineth with its other Beginning; which ariseth broad and fleshy from the upper and back part of the *Os Humeri*, under the Deltoid Muscle; and being tendinous on the outside and fleshy within, is so inserted into the superiour and external part of the *Ulna*, called *Olecranium*, and *Ancon*, or the Elbow.

ITS Use is to extend the *Cubit*. If we examine the two Beginnings of this Muscle, we shall find them interwoven with various Orders of Fibres, whereby it is render'd capable of performing the Extension of the *Cubit* with a greater Strength, as appears in Tumblers when they are walking on their Hands, who by a sudden Extension of their *Cubits* can return to their Feet.

CXIX.

Ibid.

BRACHIÆUS EXTERNUS.

THIS seems to be the third Beginning of the former Muscle. Its Origination is continued from above the middle of the inferiour and back part of the *Os Humeri* to its Cavity, which receives the *Olecranium* in the Extension of the *Cubit*, where, joining with the tendinous outside of the former, it is inserted with it, as abovesaid.

CXX.

Ibid.

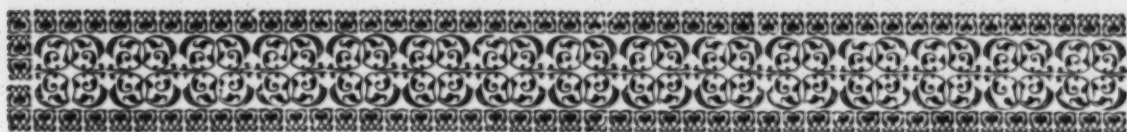
ANCONÆUS.

SO called by * *Riolan* from its Situation. It ariseth fleshy from the inferiour and back part of the *Os Humeri*, growing larger as it marcheth between the superiour Ends of the *Ulna* and *Radius*, and is inserted fleshy into the lateral part of the former about two Inches below the *Olecranium*.

THIS is also an Extender of the *Cubit*.

THE Muscles of the Palm of the Hand offer themselves next to be dissected, before we can examine those of the Carpus, Fingers, and Radius.

* *Lib. 5. Cap. 24.*



CHAP. XXVII.

Of the MUSCLES of the PALM of the HAND.



ALL the Anatomists before *Fallopius* mention but one Muscle belonging to the Palm of the Hand, except *Valverda*, who, from the Observation of *Johannes Baptista Cannanus*, adds the *Palmaris Brevis*.

CXXI.

PALMARIS LONGUS.

Tab. XLIX.
LI.

THIS has a narrow Beginning from the internal Extuberance of the *Os Humeri*, and soon becoming a fleshy Belly, contracts it self again to a long, flat, slender Tendon, marching obliquely with the Tendon of the *Flexor Carpi Superior*, and passing over the *Ligamentum Annulare*, where it expands it self, and cleaves firmly to the Skin of the Palm, and is afterwards inserted into the Roots of the Fingers laterally; it being there divided to transmit the Tendons that bend them.

COLUMBUS * observes the long beginning of this Muscle from the Extuberance of the *Os Humeri* is sometimes wanting, which Observation is also confirmed by our own Experience. It assists in grasping, and defends the subjacent Tendons from external Injuries.

CXXII.

PALMARIS BREVIS.

Ibid.

BY *Spigelius* † called *Caro Musculosa Quadrata*. Anatomists have been extremely deceived in their Ideas of this Muscle; it not arising from the *Membrana Carnosa*, as *Columbus* pretends, or from the eighth Bone of the *Carpus*, as *Fallop- pius* ‡ writes; but it springs with a broad Membrane-like Tendon from the exter-

* *Lib. 5. Cap. 33.*

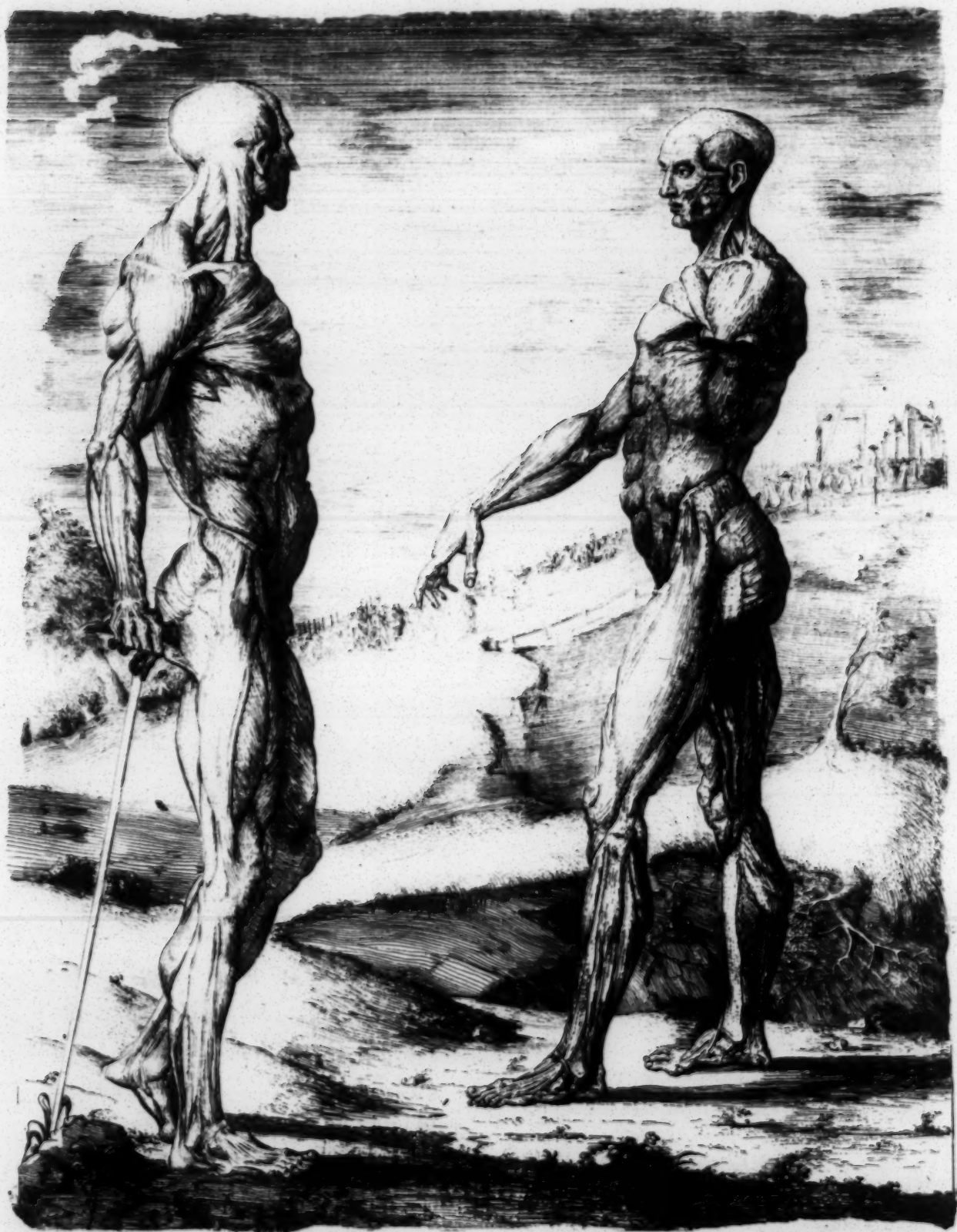
† *Lib. 5. Cap. 35.*

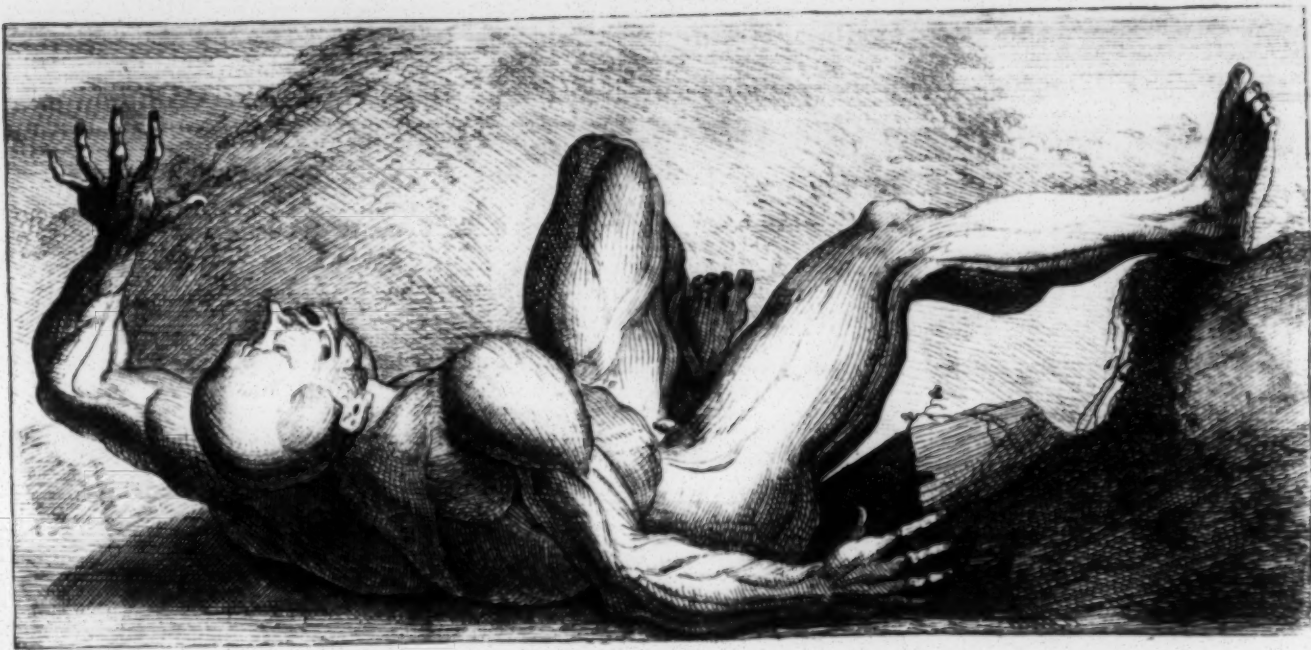
‡ *Observat. Anatom.*

Of the MUSCLES of the PALM of the HAND.

nal Part of the *Os Metacarpi Minimi Digiti*, and one of the Bones of the *Carpus*; whence ascending over the *Abductor Minimi Digiti*, it becomes a thin disgregated fleshy Muscle, marching under the tendinous Expansion of the former in the Palm, and is inserted by a short, strong Tendon, into the eighth Bone of the *Carpus*.

THIS draws the *Mons Lunæ* towards the *Os Metacarpi Minimi Digiti*, whereby the Palm becomes hollow; contrary to the Opinion of *Spigelius*, who thinks it extends the Hand, when we open it; which is not done by any proper Muscle, but by the common Extenders of the Fingers.





CHAP. XXVIII.
Of the MUSCLES of the FOUR FINGERS.



THESE we shall divide into *Common* and *Proper*. The *Common* Muscles of the Fingers are such, as arise from the external or internal Protuberances of the *Os Humeri*, and subdividing themselves, are inserted into most, if not all the Fingers; namely the *Perforatus*, *Perforans*, *Lumbricales*, and *Extensor Communis Digitorum*. The *Proper* Muscles of the Fingers are such as have their Beginnings distinct, and are inserted without any Subdivision into each respective Finger; as the *Interossei*, the *Extensor* and *Abductor Indicis*, the *Extensor* and *Abductor Minimi Digiti*. First of the *Common* Muscles of the Fingers.

CXXIII.
PERFORATUS.

Tab. II.
XLIX. LI.

SO called, because its Tendons are perforated, to admit those of the following Muscles to pass through them to their Insertions: It is also call'd *Sublimis* from its Situation, being above the following; and *Flexor secundi Internodii Digitorum* from its Use. It ariseth tendinous from the internal Extruberance of the *Os Humeri* between the *Flexores Carpi*; it also has a disgregated fleshy Origination from the fore

fore part of the *Radius*, between the *Pronator Radii Teres* and *Flexor Pollicis Longus*; afterwards composing a fleshy Belly, it lessens it self in less than half its Progress, where it's divided into four fleshy Portions, each of which soon becomes a roundish Tendon, included in its proper mucilaginous Membrane, as it passes under the *Ligamentum Transversale Carpi* through the Palm. Near the first Internode of the Fingers each Tendon is divided, to admit those of the following Muscle to pass through them, then joining, and subdividing again, immediately before they are inserted into the superiour part of the second Bone of each Finger.

CXXIV.

PERFORANS.

Tab. II. LI.

SO named, because its Tendons run through those of the former; it's also called *Profundus* from its Situation, and *Tertii Internodii Digitorum Flexor* from its Use. It arises fleshy from near two Thirds of the superiour and fore part of the *Ulna*, as also from the Ligament between the last named Bone and the *Radius*, and becoming a large thick belly'd Muscle, grows outwardly tendinous, before it passes over the *Pronator Radii Quadratus*, and is divided into four round Tendons, which march under those of the former Muscle, beneath the *Ligamentum Transversale* above-mentioned, (from each of which Tendons the *Musculi Lumbricales* are said to arise) after which they pass through the *Fissures* of those of the former Muscle, and proceeding over their Extremities, terminate in the superiour and fore part of the third Bone of each Finger.

THE running of the Tendons of the last described Muscle through those of the precedent, is a no less useful than stupendous Artifice in Nature.

THE better to accommodate the Fingers to their various Employments, and to enable them to act with greater Strength, it was necessary, that a particular Muscle should be appointed for every Internode, and that the strongest Muscle should be inserted nearest to their Extremities. Now as the *Perforatus* takes its Origine from the internal Extuberance of the *Os Humeri*, and the upper part of the *Radius*, it is plain, that this cannot be an Instrument of sufficient Strength for moving the third Internode of the Fingers, not only in regard to its Magnitude, but on the account of the approach of its two Extremes, when the Cubit is bended, which must needs be of no small Impediment to it in divers Actions. This therefore is with great Wisdom set aside for the Motion of the second Internode; and the *Perforans*, which is not only the larger Muscle, but likewise takes its Origination below the *Os Humeri*, whereby it is freed from the above-mention'd Inconvenience in the bending of the Cubit, is allotted for the Motion of the third Internode, which, as we said before, ought to be attended with the Muscle of the greatest Strength. Besides that by this Disposition a Provision is made for bending the Fingers, even when the outermost Muscle happens by any accident to be totally divided.

CXXV.

LUMBRICALES.

Tab. LI. LII.

SO called from their Figure, being not much unlike the common Earth-worms; they are also called *Flexores Primi Internodii Digitorum*, from their Use. Anatomists generally derive the Originations of these Muscles from the Tendons of the last treated of; but in a Subject lately dissected, I observed part of the Lumbrical Muscle belonging to the fore Finger had a distinct fleshy Original, and a long slender Tendon lying between the two preceding; which suggested to me, that the other three, and those of other Subjects, have their Beginnings in common with the *Perforans*, and uniting with its Tendons, are afterwards disunited again, and growing fleshy, pass to their tendinous Implantations with the *Interossei*, at the first Internode of each Finger externally and laterally, next the Thumb.

THESE, we suppose, perform those minute Motions of the Fingers, when the second and third Internodes are curvated by the two last treated of Muscles; and are therefore used in playing on Musical Instruments, whence they may be named *Musculi Fidicinales*.

CXXVI.

EXTENSOR DIGITORUM COMMUNIS, seu DIGITORUM TENSOR.

Tab. V. VII.
XLIX. LII.

THIS has an acute tendinous Origination from the outward Extuberance of the *Os Humeri*, between the *Extensores Carpi*; and becoming fleshy, in less than half its Progress is divided into three Portions, which become so many Tendons, (of which the middlemost is the longest) passing under their annular Ligaments between the lower Parts of the *Ulna* and *Radius*; then marching separately over the *Dorsum Manus*, and remitting tendinous Filaments to each other, before they pass the first Internodes of each Finger, they are afterwards inserted into the superiour Parts of the first, second, and third Bones of the fore, middle, and third Fingers.

THERE being little Force required in the Extension of the Fingers, we need not wonder that the Muscles, employed in that Office, are no larger in proportion to their Antagonists.

THE *Proper* Muscles of the Fingers now offer themselves to the Knife, which we shall treat of in the Order they are above named in.

CXXVII.

INTEROSSEI MANUS.

Tab. LI.
LII.

THESE are distinguish'd into external and internal, and are aptly named from their Situation. * Authors disagree in their Number, some reckoning six, others eight, amongst which they esteem the *Abductor Minimi Digiti* and *Indicis*; but we rather incline to the first Opinion, since the two last named Muscles are not placed between the Bones of the *Metacarpus*. They arise fleshy, internally, in the Palm from the superiour Parts of the Metacarpal Bones next the *Carpus*; whence descending between the last named Bones, they become tendinous at the first Internode of each Finger laterally, and pass to their Insertions with the last treated of Muscle, sending off in their way a small Slip to the beginning of the first Internode. Each Interstice of the Metacarpal Bones entertains two of these Muscles.

WHEN all the *Interossei* act together, they draw the Fingers nearer each other, and assist in their Extension, as *Galen* * takes notice; at which time likewise part of these Muscles, together with the *Abductor Indicis* and *Minimi Digiti*, are capable of divaricating the Fingers; which Action cannot without some difficulty be performed by them, when the Fingers are bended; which Contrivance of the most wise Architect is also observ'd by *Galen*†.

CXXVIII.

EXTENSOR INDICIS, seu INDICATOR.

Tab. V. VI.
VIII. LII.

ARISES fleshy from the middle of the external part of the *Ulna* next the *Radius*, immediately below the *Extensor Pollicis*, and descending obliquely, becomes tendinous, as it passes under its annular Ligament at the lower part of the *Radius* and *Carpus*; then passing over the *Os Metacarpi Indicis*, and joining with the Tendon of the *Extensor Communis*, it is inserted with it into the superiour Part of the third Bone of the fore Finger. The Tendon of it is sometimes divided. Its Name declares its Use.

CXXIX.

ABDUCTOR INDICIS.

Tab. LI. P.
Tab. LII.

THIS is not to be dissected, till the *Abductor Pollicis* is raised; by some it is reckoned among the *Interossei*, as above noted. It arises fleshy from the *Os Metacarpi*, that sustains the fore Finger; and descending over the first Internode of the said Finger, becomes tendinous, joining with the Tendon of one of the Lumbrical Muscles, and is inserted with it, together with the Tendon of the former Muscle. Its Name intimates its Use, in drawing the fore Finger from the rest.

* Lib. I. de Usu Part.

† Loco supra citato.

CXXX.

EXTENSOR MINIMI DIGITI.

Tab. V. VII.
VIII. LII.

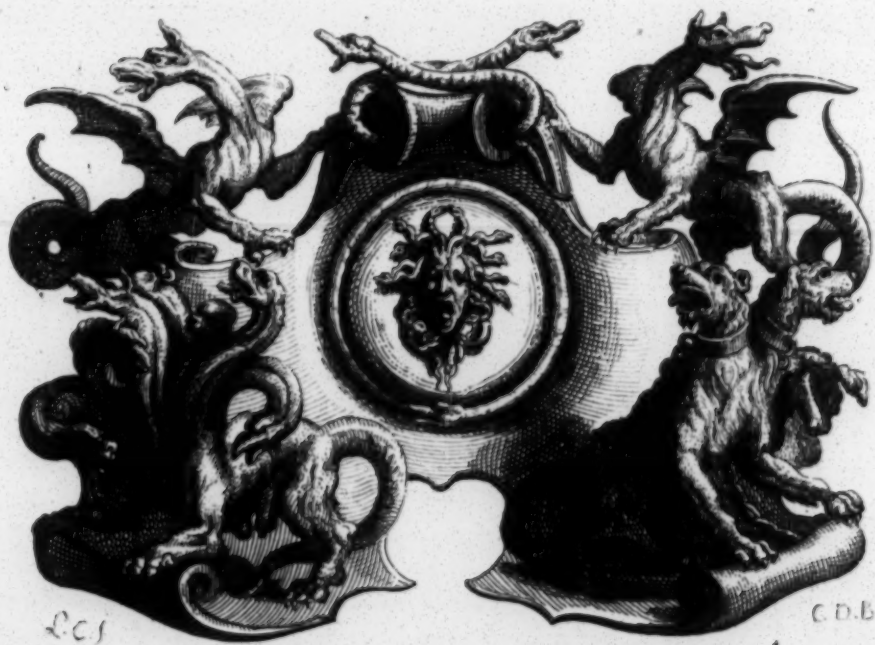
THIS arises partly tendinous at the Extremity of the external *Apophysis* of the *Os Humeri*, and partly fleshy from the superiour part of the *Ulna*, between the *Extensor Communis Digitorum* and *Musculus Ulnaris Extensor*, and becoming tendinous, as it passes under the *Ligamentum Annulare* at the *Carpus*, it is there divided into two, sometimes three Tendons, which are united into one at its Insertion into the superiour Part of the third Bone of the Little Finger. Its Name declares its Action.

CXXXI.

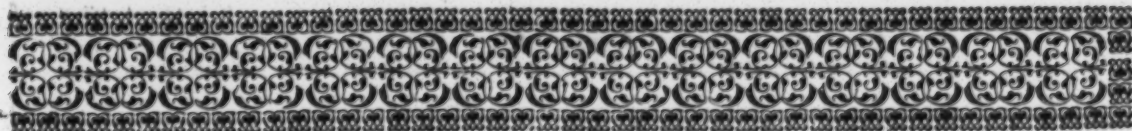
ABDUCTOR MINIMI DIGITI.

Tab. L.I.LII.

THIS appears in some Bodies divided into two or three Muscles, having each a differing Series of Fibres; the first of which seems to be a *Flexor primi Internodii Minimi Digiti*; the second an *Abductor* of the same; the third *Abductor Secundi & Tertii Internodii*. But this Division not being constant, we shall describe it as one Muscle, to avoid a needless multiplying the Number of the Muscles. It arises fleshy, first from the *Ligamentum Transversale*, and fourth Bone of the *Carpus*; secondly from the third Bone of the *Carpus*; thirdly and lastly from the superiour Part of the subjacent *Os Metacarpi*. The two first continue fleshy to their Insertions; the former terminating at the superiour part of the first Bone of the little Finger Forwards, the latter ending at the same part of the said Bone laterally; the third and last becoming tendinous like the *Interossei*, is inserted like them, with the Tendon of the *Extensor Minimi Digiti*, at the superiour part of the third Bone of the little Finger.



CHAP.



CHAP. XXIX.

Of the MUSCLES of the THUMB.

Tab. II. III.
VI. LIII.

UTHORS disagree concerning the Number, Rise and Insertions of these Muscles; which may partly proceed from that great Variety to be observ'd in divers Subjects. As they have most commonly appeared to me, I shall endeavour to represent them; and first the Benders of the Thumb.

CXXXII.

FLEXOR TERTII INTERNODII, seu LONGISSIMUS POLLICIS.

THIS we have frequently observ'd to have a twofold Beginning; the first and superiour of which arises tendinous from the internal Extuberance of the *Os Humeri*, between the *Perforatus* and *Perforans*, becoming a fleshy Belly, and then tendinous again, before it joins with the middle Tendon of its other larger Head. This first Head is sometimes wanting, and sometimes it is found springing from the superiour and fore part of the *Ulna*. The second or inferiour Origine of this Muscle is that part of it, which is commonly described, arising with a double Order of fleshy Fibres for some space on the *Radius*, from immediately below its superiour Part, which unite in a middle Line or Tendon, (not unlike the *Fibrillæ* of a Feather joining to their *Stamina*) and passing over the Articulation of the *Carpus*, it becomes entirely tendinous, as it runs over the *Flexor primi & secundi Internodii* to its Implantation at the superiour Part of the third Bone of the Thumb. For the better Dissection of the rest of the Muscles of this Part, raise first the following Muscle.

CXXXIII.

ABDUCTOR POLLICIS.

Tab. XLIX.
LIII.

THIS arises broad and fleshy from the *Os Carpi*, to which the Thumb is articulated, and the internal Part of the *Ligamentum Transversale Carpi*, whence descending, it lessens it self, and becomes tendinous at its Implantation into the superiour and external Part of the second Bone of the Thumb laterally.

THIS

THIS draws the Thumb from the Fingers, from whence it derives its Name.

CXXXIV.

FLEXOR PRIMI & SECUNDI OSSIS POLLICIS.

Tab. III.
XLIX. LIII.

THIS is a large, disgregated, fleshy Muscle, arising from the *Ligamentum Transversale Carpi*, the Bones of the *Carpus* at the *Basis* of the *Mons Lunæ*, and the *Os Metacarpi* of the middle Finger, whence it passes to its Insertion into the first and second Bones of the Thumb. That part of this Muscle, that arises from the *Os Metacarpi* of the middle Finger, is divided from its other part by the Tendon of the *Flexor Pollicis Longus* passing between them. Besides which, there is a second Division of this Muscle in that Part, which arises from the *Os Metacarpi*, insomuch that it has the appearance of three distinct Muscles, as *Vesalius* observes. In its Tendon, near the Insertion into the first Bone of the Thumb, are placed two *Ossa Sesamoidea*.

ITS Actions are various, according to the diversity of its *Series* of Fibres, bending the Thumb either directly, or obliquely, whether towards the *Carpus*, or the Palm of the Hand, which Motions are frequently made use of by Jugglers.

CXXXV.

ADDUCTOR POLLICIS.

Tab. LI. O.
Tab. LIII.

THIS arises tendinous in common with the *Abductor Indicis* from the *Os Metacarpi* of the fore Finger, and becoming fleshy, ascends obliquely to its tendinous Termination at the superiour part of the first Bone of the Thumb. This brings the Thumb nearer the fore Finger.

THE rest of the Muscles employed in the Motion of the Thumb are Extenders. Though Anatomists generally reckon but two of them, yet it does not occur to our Memory, that we ever found less than three distinct fleshy Muscles; neither do the Figures, that seem to be done after the Life, in *Vesalius* and *Bidloo*, exhibit them otherwise.

CXXXVI.

EXTENSOR PRIMI INTERNODII POLLICIS.

Tab. XLIX.
LIII.

THIS arises partly tendinous, but chiefly fleshy, from the upper Part of the *Ulna*, immediately below the *Supinator Radii Brevis*, soon growing fleshy, and becoming tendinous again, as it descends obliquely over the Tendons of the *Radialis Extensor*, and is inserted into the lower part of the first Bone of the Thumb. This we have sometimes found divided into two, and sometimes three, distinct Muscles.

CXXXVII.

Ibid.

EXTENSOR SECUNDI INTERNODII POLLICIS.

THIS arises broad and fleshy from part of the *Radius* next the *Ulna*, and becoming tendinous, passes under the same *Involucrum* with the Tendons of the former, to its Implantation at the lower part of the second Bone of the Thumb.

CXXXVIII.

Ibid.

EXTENSOR TERTII INTERNODII POLLICIS.

THIS has a broad, partly tendinous, but chiefly fleshy Origination from the *Ulna*, immediately below the beginning of the *Extensor Primi Internodii*, or between it and the *Indicator*, as also from the Ligament between the last named Bone and the *Radius*; whence descending obliquely, it becomes tendinous, as it marches in a proper *Sinus* on the inferiour Appendix of the *Radius*, wherein it is inclosed by its annular Ligament, and passes over the two Tendons of the *Radialis Extensor*, to its Insertion at the lower part of the third Bone of the Thumb.

WHEN this acts, it does not only extend the Thumb, but brings it somewhat backwards, in so much that some Persons can bring it over the superiour and back part of the *Ossa Metacarpi*





CHAP. XXX.

Of the MUSCLES of the WRIST, or CARPUS.



THESE are well described by most Authors, and receive their Names from their Situation and Use.

CXXXIX.

FLEXOR CARPI RADIALIS.

Tab. XLIX.
LIII.

THIS arises tendinous from the internal Extubérance of the *Os Humeri*, and becoming fleshy, adheres strictly to the *Pronator Radii Teres*; and in half its oblique Progress to the *Carpus*, it becomes a flat Tendon, which passeth under the annular Ligament, and is inserted into the upper part of the *Os Metacarpi*, which sustains the fore Finger.

CXL.

FLEXOR CARPI ULNARIS.

Ibid.

THIS arises partly fleshy, but chiefly tendinous, from the same Tubercle of the Shoulder-Bone with the former, as also from the superiour and external Part of the *Ulna*, where the *Musculus Perforans* arises; and continuing fleshy according to the length of the *Ulna*, is partly inserted by a short, strong Tendon, into the fourth Bone of the *Carpus*, and partly into the *Os Metacarpi*; which sustains the little Finger.

CXLI.

EXTENSOR CARPI RADIALIS.

Ibid.

BY some called *Bicornis* and *Radiæus Externus*. It hath two Beginnings, and indeed seems to be two distinct Muscles, the outermost arising fleshy above the external Protuberance of the *Os Humeri*, immediately below the *Supinator Radii Longus*, in its descent becoming a fleshy Belly, and growing tendinous above the

the middle of the *Radius*. The other Beginning of this Muscle is partly fleshy and partly tendinous below the former, either from the *Apex* of the outward Extuberance of the *Os Humeri*, or the superiour Part of the *Radius*, and continues fleshy somewhat lower than the other; both Tendons marching under the *Extensores Pollicis*, run under the *Ligamentum Annulare*, and are inserted into the superiour Parts of the *Offa Metacarpi* of the fore, and middle Fingers.

CXLII.

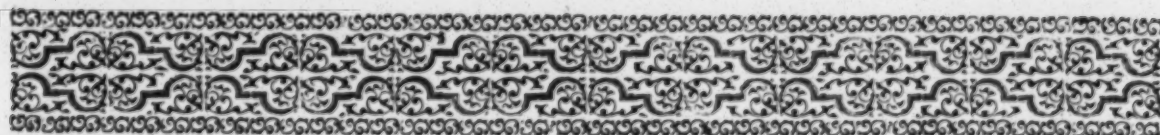
EXTENSOR CARPI ULNARIS.

Ibid.

THIS hath an acute tendinous Beginning from the outward Extuberance of the *Os Humeri*, and becomes fleshy, as it descends according to the length of the *Cubit*, growing tendinous again as it marches over the inferiour part of the *Ulna*; and passing under the annular Ligament, it is inserted into the superiour Part of the Metacarpal-Bone of the little Finger.

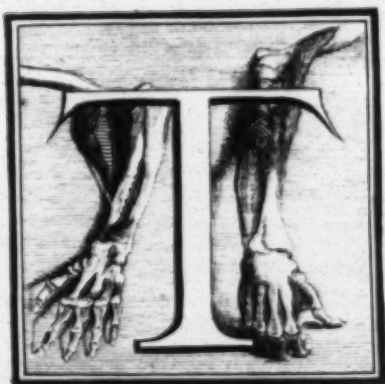
If this Muscle and the *Ulnaris Flexor* act, they move the Hand sideways towards the *Ulna*; and in like manner, if the *Radialis Flexor* and *Extensor* act, they move it towards the *Radius*. It is well observed by most Authors, that the Extenders, whether belonging to the Fingers or *Carpus*, arise from the outward Extuberance of the *Os Humeri*, and their Antagonists the Flexors, from the internal Protuberance of the same Bone, as also from the superiour and external Part of the *Ulna*, next the *Anconæus* (above treated of.)





CHAP. XXXI.

Of the MUSCLES of the RADIUS.



THE *Radius* is bent and extended in common with the *Ulna*, or *Cubitus*; but besides that, it hath also a proper Motion, in which the *Carpus* together with the Hand is chiefly moved, or turned, either upwards or downwards. To this end there are two sorts of Muscles; of which some are called *Pronatores*, or those that turn the *Radius* inwards, and the Palm of the Hand downwards; and others *Supinatores*, which turn it outwards, and the Palm of the

Hand upwards. These have their Names from their Figure and Use.

CXLIII.

PRONATOR RADII TERES.

Tab. XLIX.
LIV.

HAS two Beginnings; the one from the internal Extuberance of the *Os Humeri*, where the Muscles bending the *Carpus* and Fingers arise; the other from the upper Part of the *Ulna*. From these two Heads its fleshy Body marches obliquely, adhering strictly to the *Flexor Carpi Radialis*, so as not to be fairly separable from it, in its Passage to its tendinous Insertion a little above the middle of the *Radius* externally.

CXLIV.

PRONATOR RADII QUADRATUS, or INFERIOR QUADRATUS.

Tab. III.
LIV.

IT ariseth with a broad Tendon, from the lower and inner Part of the *Ulna*, and passing transversly over the Ligament, that joins the *Radius* to the *Ulna*, is so inserted into the superiour and external Part of the *Radius*.

CXLV.

SUPINATOR RADII LONGUS.

Tab. XLIX.
LIV.

THIS ariseth broad and fleshy from the external Part of the *Os Humeri*, three Fingers breadth below the Termination of the *Deltoides*; and descending obliquely inwards, it gradually lessens it self, and becomes a flat, broad Tendon, which likewise grows narrower till it is inserted into the internal and inferiour Part of the *Radius*, near the *Carpus*.

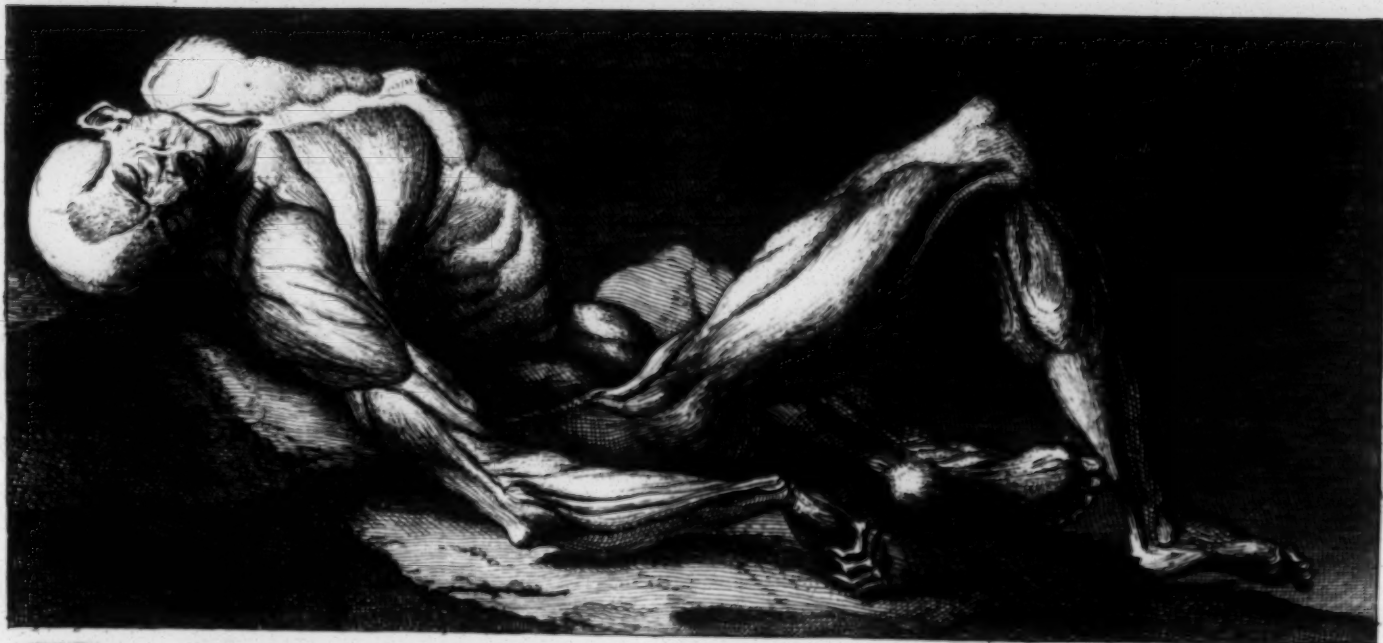
CXLVI.

SUPINATOR RADII BREVIS.

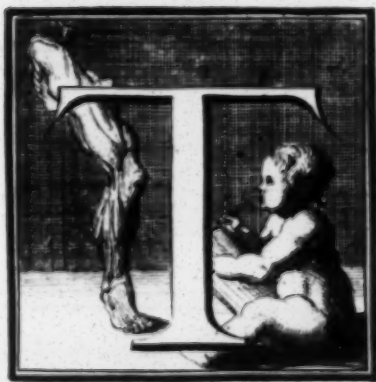
Tab. V. VI.
IX. LIV.

THIS ariseth partly tendinous, and partly fleshy, from the superiour and external Part of the *Ulna* next the *Radius*; and passing obliquely over that Bone, is so inserted into its superiour Part below the Prominence of the *Radius*, where the round Tendon of the *Biceps* endeth.

WE come next to the Muscles of the Thigh, Leg, and Foot. Though Riolan sharply reprehends Caspar Bauhin, in his Animadversions on his Theatrum Anatomicum, for Male-administration of the Muscles of the Leg, before those of the Thigh, alledging that those of the Thigh may be all demonstrated, while the Muscles of the Leg remain untouched; yet we cannot agree with him in that particular, knowing it to be absolutely necessary to separate divers Muscles of the Tibia, as well as to cut off some of those moving the Os Femoris it self, before we can have a tolerable Prospect of others; especially the Rotator Femoris Extrorsum. However since some Muscles, which belong to the Thigh, arise from the Vertebrae of the Back, Loins, and Os Sacrum, we shall begin with them, and then divide the Os Ilium from the Sacrum, and remove the Trunk of the Body; which Practice is not only convenient for Dissection, in respect that the Limb is more easily turned to and fro upon the Table; but in publick Demonstrations is done to avoid an offensive Scent apt to arise from the Trunk. This done, proceed to dresse the rest of the Muscles of the Skin, Fat, and Membranes; taking care that the Fascia Membranosa of the Thigh and Leg be not wounded, and that you likewise take off all the Fat in the Planta Pedis, and avoid cutting the long Tendon of the Musculus Plantaris, as it descends by the inside of the great Tendon of the Gastrocnemii, near the Os Calcis.



CHAP. XXXII. Of the MUSCLES of the THIGH.



THE Enumeration, Description and Office of the Muscles belonging to this Part, is variously set down by different Authors. * *Galen*, † *Vesalius*, and ‡ *Columbus* mention ten, viz. *Psoas*, *Iliacus Internus*, *Pectineus*, *Glutæus Major*, *Glutæus Medius*, *Glutæus Minor*, *Pyriformis*, *Marsupialis*, *Triceps*, and *Obturator Externus*. To these ** *Falloppius* adds another called *Quadratus Femoris*, whose Invention †† *Riolan* pretends is due to *Sylvius*, and describes another, which he calls *Psoas Parvus*, lying on the great *Psoas*. To these ††† *Tho. Bartholin* adds yet another distinct from that mentioned by *Riolan*, lying beneath it, having the same fleshy Beginning about three Fingers in breadth, and being so inserted into the upper Edge of the *Os Ilium* backwards, where the *Iliacus Internus* arises: This he tells us he found in a strong Muscular Body in the Year 1651; and the following Year he says he saw it with *Michael Lyserus*, who had observed it in a Monkey to equal the great *Psoas*. That mentioned by *Riolan* we have frequently observ'd, which notwithstanding is absent in some Bodies, as he has well remark'd. But the latter of *Bartholin* I could never yet discover. If any such be

* *De Musc. Cap. 31.*

† *Lib. 2. Cap. 56.*

‡ *Lib. 5. Cap. 28.*

** *Observat. Anatom.*

†† *Animad. in Theat. Anatom. Baubini & Anthropog. Lib. 5. Cap. 41.*

††† *Lib. 4. Cap. 11.*

found,

found, I conjecture it should rather be referred to the Loins, together with the *Quadratus Lumborum*, of which I suspect it is a Part, that may sometimes be distinct. The like *Lusus Naturæ* we frequently find in other Cases, of which the *Rhomboides Scapulae* and *Triceps Femoris* afford us Examples.

CXLVII.

PSOAS PARVUS.

Tab. LIV.

THOUGH this ought to be counted among those belonging to the Loins, yet for its subserviency to the great *Psoas*, and our better convenience in Dissection, we choose rather to reserve it for this Place. It arises fleshy from the superiour part of the first *Vertebra* of the Loins internally and laterally, within the Cavity of the *Abdomen*, immediately below the *Diaphragm*, whence it descends obliquely inwards, towards the *Pelvis Abdominis*, where it ceases to be fleshy, in a manner embracing the great *Psoas*, and is inserted with a thin, broad, strong Tendon, into that part of the *Os Pubis* that is joined to the *Os Ilium*. This Muscle with its Partner may assist the *Recti Abdominis*, in drawing the *Offa Pubis* upwards, as in raising our selves from a decumbent Posture. Thus Rope-dancers hang by their Hands, and raise the inferiour parts of their Bodies, to take hold of the Rope with their Feet, though their proper Action seems to be to bend the Loins. The Tendons of these Muscles, embracing the two following, which we have frequently observed to extend over their inferiour Parts, not unlike the *Fascia Tendinosa Cubiti*, and *Lata* of the Thigh, do also corroborate them in their Action.

CXLVIII.

PSOAS MAGNUS, seu LUMBALIS.

Tab. III. VI.
LIV. LV.

SO called from its Situation. It's a round, somewhat large and fleshy Muscle, arising from all the *Vertebrae* of the Loins, and their transverse Processes, internally and laterally, within the Cavity of the *Abdomen*; from thence descending over the superiour part of the *Os Sacrum*, and Spine of the *Ilium*, where it is joined with the fleshy Fibres of the following Muscle, with which its inseparably united, at their partly fleshy, and partly tendinous Insertion into the inferiour part of the lesser *Trochanter* of the Thigh-Bone.

THIS assists the following in its Action.

CXLIX.

ILIACUS INTERNUS.

Tab. III. VI.
LIV.

THIS arises fleshy from above half the superiour, internal, concave part of the *Os Ilium*, and in its descent over the inferiour part of the same Bone, joins with the former, and is inserted with it as above-said, partly under the Termination

tion of the following Muscle. This together with the former move the Thigh forwards in Progreſſion.

CL.

PECTINEUS.

Tab. VI.
LIV.

SO called from its beginning at the *Os Pubis* or *Pectinis*. It has a thick, broad, and fleshy Origination from the external part of the ſaid Bone, between the two laſt deſcribed Muſcles and ſecond Head of the *Triceps*, and deſcending obliquely backwards, it becomes a flat ſtrong Tendon near its Implantation into the Aſperity on the poſterior part of the *Os Femoris*, immediately below the leſſer *Trochanter*, at the Inſertion of the two former Muſcles.

THIS acting together with the two preceding, does not only aſſiſt in drawing the *Os Femoris* upwards, but likewise directs it outwards, by its Curve deſcent from its Origination to its Inſertion at the poſterior part of the *Os Femoris*; which is a provident Contrivance of Nature in our walking, ſince the Thigh-bones, by their oblique Poſition, render the Toes liable to turn inwards. Theſe three laſt treated of Muſcles, beſides the *Recti Abdominis*, and *Pſoas Parvus* on each ſide, ſeem to ſerve for the Inflexion of the Body, and to direct the whole Limb, to wit, the Thigh, Leg, and Foot outward, in a more graceful Step.

THE *Musculus Membranofus* preſents it ſelf next to the Knife; therefore muſt be raiſed, before we can gain a View of the reſt of the Muſcles, which move the Thigh-bone. This may be done, either by cutting it from its fleſhy Origination at the point of the Spine of the *Os Ilium*, and turning it downwards; or after its well cleared of the Skin, Fat, and Membranes, it may be raiſed contrariwiſe, by cutting off its tendinous Inſertion at the ſuperiour Appendix of the Fibula, freeing it from all the Muſcles of the Tibia, and leaving it at its Origination. Either of theſe being done, proceed to raiſe the *Pyriformis* from its Origine within the Pelvis of the Abdomen, and part of the fleſhy Beginning of the *Glutæus Major*, from the external part of the *Os Sacrum* and *Coccygis*. The Body then being laid in a Supine Poſture, and the Legs divaricated, with a thin Knife firſt divide the *Oſſa Pubis* from each other, and then the *Os Ilium* from the *Sacrum*.

CLI.

GLUTÆUS MAJOR.

Tab. V. VII.
LV. LVII.

SO called from its being the largeſt Muſcle of thoſe, which compoſe the Buttocks. It has a large ſemicircular Beginning; forwards merely tendinous, from near two thirds of the external part of the Spine of the *Os Ilium*; backwards its Origination is thick and fleſhy from the poſterior part of its Spine, the hindmoſt part of the *Sacrum* laterally, and the whole *Os Coccygis*, as alſo from a broad Ligament, that's extended between the two laſt named Bones and the Tubercle of the *Os Iſchium*; its fleſhy Fibres, deſcending diſgregately, in an almoſt ſemicircular

B b

manner,

manner, become tendinous, as they approach the great *Trochanter*, where it is united with its first described tendinous Beginning, descending over the external part of the great *Trochanter*; then after being joined with the Tendon of the *Membranofus*, it proceeds to cover and strictly embrace all the external Muscles of the *Tibia*, as the external Tendon of the *Biceps* does those of the *Cubit*: But the other part of it proceeding from the fleshy Body of this Muscle, is largely inserted into the *Linea Aspera* on the back Part of the *Os Femoris*, near four Fingers breadth below the Great *Trochanter*.

THE first described tendinous Beginning of this Muscle doth not only serve to support its fleshy Body, but its Fibres intersecting those of the *Membranofus*, as they cover all the Muscles of the *Tibia*, do more adequately include them, whereby they are corroborated in their Action. When this Muscle acts, it pulls the Thigh directly backwards.

CLII.

GLUTÆUS MEDIUS.

Tab. VII.
VIII. LV.
LVIII.

THIS lies chiefly under the tendinous beginning of the former Muscle, and arising fleshy from almost the whole external part of the Spine of the *Os Ilium*, in its Descent becomes thicker and fleshy, and is inserted by a short strong Tendon into the superiour and external part of the great *Trochanter* in a semicircular manner.

IF the differing Series of Fibres in this Muscle are rightly consider'd, their Position will manifest, that they are not so useful in extending the Thigh, as Authors would persuade us, but rather employed in turning it inwards. This will plainly appear, if in the time of Dissection you give the Thigh that Motion, for you then may observe the fore part of this Muscle notably relax'd. And in living Persons, when the Thigh is turned inwards, you may see it tumified; or if, in performing that Action with your own Thigh, you lay your Thumb on this Muscle, you may feel it contract or move under the Skin. Besides its being partly useful in extending the Thigh with the former Muscle, it is also employ'd in divaricating the Legs, it co-operating with the *Musculus Membranofus* in that Action.

N. B. IN raising this Muscle, begin towards the back Part of the *Os Ilium*, and thrust in your Finger between it and the *Glutæus Minor* lying under it, by which means they will easily be separated.

CLIII.

GLUTÆUS MINOR.

Tab. VI.
VIII. LVI.
LVIII.

LIES totally under the former Muscle, being as much less than the former, as the former is than the Precedent. It riseth semicircular, broad and fleshy, from the *Dorsum Ilii*; from hence its fleshy Fibres descend to their tendinous Insertion at the superiour part of the Root of the great *Trochanter*.

THE

THE Fibres of this running parallel with those of the former, assist it in all its Actions. Whatsoever Authors have said concerning a *Rotator Femoris Introrsum*, we are well assured, that there is no other Muscle employ'd in that Action, but the fore Parts of these two only. They also assist in rendring the Articulation of the Thigh Bone with the *Coxa* more stable, in standing erect.

CLIV.

PYRIFORMIS, seu ILIACUS EXTERNUS.

Tab. VIII.
LVI. LVIII.

RECEIVES its first Name from its Figure, the second from its Situation. Its Beginning is round and fleshy from the inferiour and internal Part of the *Os Sacrum*, in the *Pelvis* of the *Abdomen*; and descending obliquely in the great *Sinus* of the *Os Ilium*, above the acute Process of the *Ischium*, and joining with the *Gluteus Medius*, it is inserted by a round Tendon into the Root of the great *Trochanter*. This moves the *Os Femoris* somewhat upwards, and turns it outwards.

CLV.

MARSUPIALIS, seu BURSALIS.

Ibid.

SO called from its tendinous running through (as it were) a second fleshy Beginning of it self, which Duplication represents a Purse: It is also called *Obturator Internus* from its Situation upon the great round hole of the *Os Ischium*, which it fills and stops up. It ariseth broad and fleshy from part of the *Os Ilium*, *Ischium*, *Pubis*, and Ligament that is extended in the great *Foramen* of the two last named Bones internally, and marching transversly in the *Sinus* of the *Ischium*, fenced on each side by two Processes, the one acute, the other obtuse, is externally fleshy, but internally hath three, some times four or five Tendons, passing in so many distinct Furrows in the said *Sinus*, like so many Cords in a Quadruple Pulley, where it meets with the other fleshy Beginning, commonly called its *Marsupium*, arising from the above-mentioned acute and obtuse Processes, which joins with the said Tendons at their united Insertion into the superiour part of the Root of the great *Trochanter*, near the Implantation of the former Muscle.

RIOLAN * makes two Muscles of the *Marsupium*; which Error is taken notice of by † *Marchette*.

WHEN this Muscle acteth, its Insertion is directed towards that part of the *Ischium*, over which its Tendons run after the manner of a Pulley, and the *Os Femoris* is thereby turned outwards.

* *Anthrop. Lib. 5. Cap. 41.* † *Anatom. Cap. 19.*

CLVI.

Ibid.

QUADRATUS FEMORIS.

SO called from its Figure. It ariseth broad and fleshy from the *Apophysis* of the *Os Ischium*, and passes transversely, with an equal Breadth and Thickness, to its partly fleshy, and partly tendinous Insertion at the posteriour part of the *Os Femoris*, partly below the great *Trochanter*.

THIS assists the former Muscle in turning the Thigh-Bone outwards.

N. B. *By thrusting in your Finger between this and the Obturator Externus, lying under it, you'll easily raise the one and discover the other.*

CLVII.

*Tab. IX.
LVI. LVIII.*

OBTURATOR EXTERNUS.

SO called from its Situation, and *Rotator Femoris Extrorsum* from its Use. It hath a large fleshy Beginning from the external Parts of the *Os Ischium*, *Pubis*, and Membrane, that covers their *Foramen* externally, opposite to the Origination of the *Marsupialis*, or *Obturator Internus*, (already described) and passing transversely backwards, lessens it self, and becomes tendinous at its Insertion into the Root of the great *Trochanter* of the Thigh-Bone, near the Termination of the last named Muscle. This turns the Thigh outwards.

CLVIII.

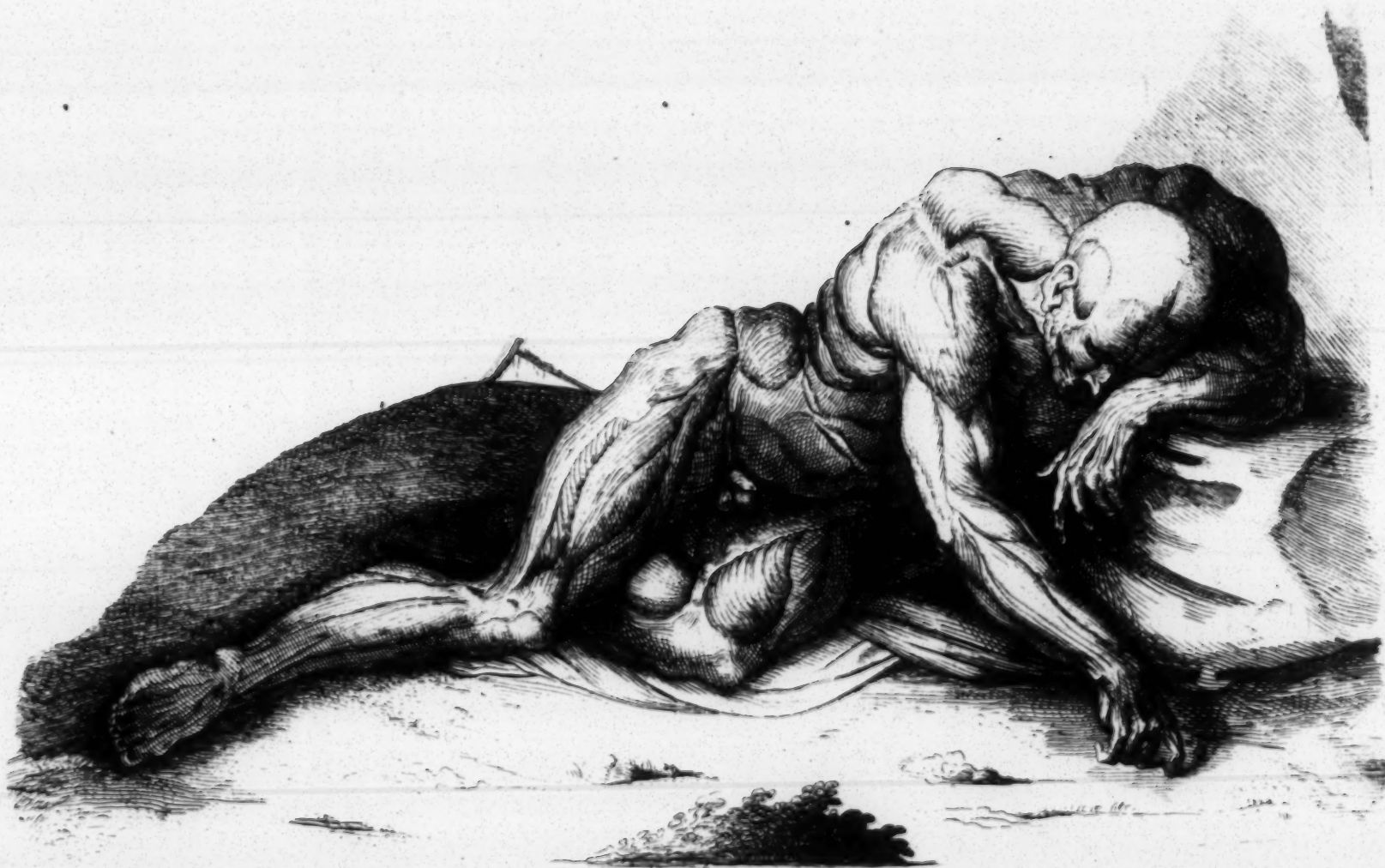
*Tab. III. VI.
IX. LVI.
LIX.*

TRICEPS.

SO called from its three Heads or Beginnings; the first and largest of which ariseth broad and fleshy from the inferiour Edges and external Parts of the *Os Ischium* and *Pubis*, where they are joined to each other, lying between the *Semitendinosus* and the *Gracilis*, and descending with an oblique Order of fleshy Fibres, is inserted partly tendinous, and partly fleshy, near an Hands length in Breadth into the *Linea Aspera* of the Thigh-Bone immediately below the Insertion of the *Quadratus Femoris*; its inferiour part making a strong round Tendon, inserted into the superiour part of the internal and lower *Appendix* of the Thigh-Bone. The second Head or Beginning of this Muscle ariseth tendinous from the *Os Pubis*, but in its descent soon becomes fleshy, and joins with the former, near to its Insertion into the middle part of the *Linea Aspera* of the Thigh-Bone. The third and last Beginning of this Muscle springeth from the inferiour part of the *Os*

Os Pubis, between the Origination of its last described Head, and that of the *Pectineus*, and descending obliquely, joins with the first, near its Insertion into the *Linea Aspera* of the Thigh-Bone, immediately above the Termination of the second Head.

THIS moves the Thigh variously according to the diversity of its Beginnings; for the first described Part of it pulls the Thigh-Bone upwards, inwards, and somewhat backwards; the second and third Beginnings of it pull it more inwards, and turn it somewhat outwards, as when we put our Legs a-cross each other.





CHAP. XXXIII.

Of the MUSCLES of the LEG.



OLUMBUS * and *Spigelius* † after *Galen* ‡ mention ten Muscles, which move the *Tibia*, namely, *Membranofus*, *Sartorius*, *Gracilis*, *Seminervofus*, *Semimembranofus*, *Biceps*, *Rectus*, *Vastus Externus*, *Vastus Internus*, and *Popliteus*. To these *Jacobus Sylvius* **, *Laurentius*, and later Authors, add another Muscle lying between the two *Vasti*, and call it *Crureus*. Of these, we reckon the first seven, as Common both to the Thigh and Leg, since they

arise either from the *Os Ilium*, *Pubis*, or *Ischium*, and are inserted into the *Tibia*, or *Fibula*, in moving of which they move the Thigh also: The other are *Proper*, arising from the *Os Femoris* only, and being inserted into the *Tibia*.

CLIX.

MEMBRANOSUS.

Tab. I. V.
LV. LVII.

SO called from the large membranous Expansion it is continuous with, inclosing all the Muscles of the *Tibia* and *Tarsus*; whence it is also called *Fascia Lata*. It hath an acute fleshy Beginning from the fore part of the Spine of the *Os Ilium*, between the Origination of the *Sartorius* and tendinous Beginning of the *Gluteus Magnus*; and being dilated to a fleshy Belly, fills the Interstice made by the first of the two last named Muscles and upper part of the *Rectus*, and the fore part of the *Gluteus Medius*. In its oblique Descent it becomes tendinous, four Fingers breadth below the great *Trochanter*, whence it passes directly over the *Vastus Externus* to its proper Termination, at the superiour *Appendix* of the *Fibula*; but in its progress thither it is conjoined with the tendinous Expansion of the *Gluteus Magnus*, which ariseth from the Spine of the *Os Ilium*, covering the external part of the *Gluteus Medius*. This united Expansion, or *Fascia*, embraces all the external Muscles of the *Tibia*, as well as those of the Thigh-Bone; and descending over the *Patella*, comprehends the Muscles of the *Tarsus*, and joins with the

* *Lib. 5. Cap. 29.*

† *Lib. 4. Cap. 32.*

‡ *De Muscul.*

** *Isagog. Anatom. lib. 5. cap. 29.*

Ligamentum

Ligamentum Annulare, which retains the Tendons of the Toes and Foot, unless it may be supposed that this *Fascia Lata* should end at the lower part of the Thigh-Bone, or superiour parts of the *Tibia* and *Fibula*, and that the last named Bones should give an Origination to the inferiour part of the said *Fascia*, which seems to be a Matter more of Controversy than Use. When this Muscle acteth, the Leg and Thigh are drawn outwards. Its tendon being joined with part of the *Gluteus Maximus*, and having a different Series of Fibres intersecting the other, they do thereby compose a strong *Involucrum*, as well including all the Common Muscles of the Leg, as covering the *Proper*; whereby they corroborate them in their Action, as the tendinous Expansion of the *Biceps Cubiti* doth those of the *Carpus* and *Fingers*.

CLX.

SARTORIUS.

Tab. I. LV.
LVI. LIX.

IT receives this Denomination from the Use Taylors make of it, in bringing one Leg and Thigh over the other, to sit cross-leg'd: It is also called *Longissimus Femoris*, it exceeding the rest of the Muscles of that part in Length, and *Fascialis*, from its passing over the Muscles of the Thigh and Leg like a Swathe. It ariseth sharp and fleshy from the fore part of the Spine of the *Os Ilium*, close by the former Muscle; and descending obliquely inwards above the *Musculus Rectus* and *Vastus Internus*, and over part of the *Triceps*, of an equal Breadth and Thickness, meets with the *Gracilis*, below the middle of the Thigh internally, and descending with it, becomes tendinous in its Passage over the internal and inferiour Head of the Thigh-Bone, (under a strict Inclosure of the above describ'd *Fascia Lata*) and is inserted four Fingers Breadth below the superiour part of the *Tibia*, internally. Its Use is declared above.

CLXI.

GRACILIS.

Ibid.

SO called from being the slenderest of these Muscles: It ariseth somewhat broad and tendinous from the *Os Pubis* internally, between the first and second described Heads of the *Triceps*; and in its strait Descent in the inside of the Thigh, its fleshy Body grows narrow, and becomes tendinous a little above the former Muscle, and is so inserted (immediately beneath it) into the *Tibia*.

It assisteth the former Muscle, in bending the Thigh and Leg inwards.

CLXII.

CLXII.

BICEPS.

Tab. V. VII.
VIII. LV.
LVI. LX.

OR *Biceps Femoris*, to distinguish it from that of the *Cubit*: It having two Heads, the superiour and longest of which ariseth with a round Tendon from the Protuberance of the *Ischium*; in its Descent it becomes large and fleshy, and in above half its progress lessens it self again, where it is joined with its other Head, having a broad, partly tendinous and partly fleshy Beginning from the *Linea Aspera* of the *Os Femoris*, immediately below the Termination of the *Gluteus Maximus*; it being thus united, grows tendinous, as it marcheth in a Chanel on the external part of the lower *Appendix* of the *Os Femoris*, becoming perfectly tendinous at its Implantation into the superiour *Epiphysis* of the *Fibula*.

BESIDES the Office commonly assigned to this Muscle, in bending the *Tibia* together with the two following, it is likewise employed in turning the Leg, together with the Foot and Toes, outwards, when we sit with the Knees bended.

CLXIII.

SEMINERVOSUS, seu SEMITENDINOSUS.

Tab VII.
VIII. LV.
LVI. LX.

WHICH is so called from its being half tendinous, and Nerve-like. It ariseth partly tendinous, and partly fleshy, from the external part of the Protuberance of the *Os Ischium*; and presently being dilated to a large fleshy Belly, becomes a round Tendon in half its progress, which descending over the fleshy Belly of the following Muscle, marcheth close by the *Gastrocnemius* on the posteriour part of the superiour *Appendix* of the *Tibia*, from whence it passes forwards to its Insertion into the said Bone, immediately below the Termination of the *Gracilis*.

THIS with the following Muscle bend the *Tibia* directly backwards. Its Tendon, together with those of the three former and the following Muscle, make the Hamstrings, as they are commonly called.

CLXIV.

SEMIMEMBRANOSUS.

Ibid.

SO called from its being half tendinous and Membrane-like, lying immediately under the former Muscle. It ariseth broad and tendinous from the Protuberance of the *Os Ischium*; in its Descent it becomes broader, and in less than half its progress begins to grow fleshy, (where the Belly of the former Muscle lessens it self) and is dilated into a large and fleshy Belly, lying under the long round Tendon of the former, becoming a short thick Tendon inserted into the superiour part of the upper *Appendix* of the *Tibia* backwards.

N. B. THAT the fleshy Belly of the former Muscle is above, and that of this is below, and their Tendons on the contrary.

CLXV.

CLXV.

POPLITEUS.

Tab. VIII.
IX. LVI.
LX.

BY some called *Subpopliteus*, ariseth with a short, strong Tendon, from a *Sinus* in the external Head of the inferiour *Appendix* of the *Os Femoris*; from whence descending obliquely over the Juncture, it becomes fleshy, and expanding itself, is so inserted into the superiour part of the *Tibia* internally, immediately below its superiour *Appendix*. This doth not only assist the three former Muscles in bending the *Tibia*, but antagonizeth the *Biceps* by turning the Foot and Toes inwards.

CLXVI.

RECTUS FEMORIS.

Tab. I. II.
LV. LXI.

IS named from its streight Progress and Situation; it ariseth fleshy from a Tubercle of the *Os Ilium*, that is in the mid-way between the fore part of its Spine and the *Acetabulum*, as likewise from the Margin of the *Acetabulum*; from whence descending directly between the two following Muscles, and over the *Crureus*, its Fibres externally descend from a middle Line obliquely, laterally; internally they run according to its Length, and become entirely tendinous, four Fingers breadth above the *Patella*, where it is united with the Tendons of the three following Muscles, and inserted together with them at the upper part of the *Tibia*.

CLXVII.

VASTUS EXTERNUS.

Ibid.

SO called from its Magnitude and Situation; it arises outwardly tendinous, and inwardly fleshy, from the external part of the great *Trochanter* and the *Linea Aspera* of the Thigh-Bone, from whence its Fibres descend obliquely forwards, and on the contrary become outwardly fleshy, and tendinous internally; and so soon as they meet with the Tendon of the former Muscle, grow perfectly tendinous, and join with it, and those of the two following.

CLXVIII.

VASTUS INTERNUS.

Ibid.

THIS is like the former hath its Denomination from its Situation and Magnitude: Its Beginning is large, partly tendinous, and partly fleshy; it being continued from the *Linea Aspera* on the back part of the Thigh-bone, from immediately below the lesser *Trochanter*, till within three Fingers breadth above the

D d

inferiour

inferiour *Appendix* of the said Bone internally, and laterally; from hence its fleshy Fibres descend obliquely outwards, in an almost semicircular manner, and on a sudden (like the former Muscles) ceasing to be fleshy, its Tendon is united with that of the *Rectus*, together with the former and following Muscles, and inserted with them.

CLXIX.

CRUREUS, seu FEMOREUS.

Tab. II. VI.
LVI. LXI.

SO called from its Situation on the Bone of the Thigh, like the *Musculus Brachialis*, on that of the Arm: Its Origination is large and fleshy, being continued from between the greater and lesser *Trochanter* of the Thigh-Bone forwards, to its lower part, that is immediately above its inferiour *Appendix*; hence its fleshy Fibres descending directly, become perfectly tendinous, a little below the upper part of the Tendon of the *Rectus*, where it joins with it and the Tendons of the two last described Muscles, and passes over the external part of the *Patella*, (or on each side of it) and is inserted into a Prominence at the superiour and fore part of the *Tibia*.

THESE four Muscles last treated of, viz. *Rectus*, *Vastus Externus*, *Vastus Internus*, and *Crureus*, may be esteemed one, in regard they make but one Tendon at their Insertion, and serve for the same Use in extending the *Tibia*, or Leg, however they are divided into several Bodies, and one of them is inclosed on all sides by the *Fascia Lata*, namely the *Rectus*, and in themselves they have a multiform Series of fleshy Fibres, whereby they are render'd capable of performing their Office with greater Strength, which is absolutely necessary, not only in Running, Walking, Leaping, &c. but in Standing, to keep the Body erect, by opposing that Flexure at the Knee, which must otherwise necessarily happen through the superincumbent Pressure made by the whole Body. For this reason likewise we find these extending Muscles in so great a proportion larger than their Antagonists the Benders, which appeared by their Weight, when at the Request of my very good Friend Dr. Brown, (then Reader on the Muscular Dissections at Chirurgeons-Hall) these extending Muscles were weighed, and likewise their Antagonists the Benders in the same Body, whereby we found the former exceeded the latter two Pounds wanting an Ounce; the former, namely the *Extensores*, weighing three Pounds six Ounces, and their Antagonists the latter but one Pound seven Ounces. In another Body the Extenders weigh'd four Pounds, eight Ounces and a half, and the Benders but two Pounds two Ounces. Besides which, the Extenders have still a farther Advantage given them by Nature: For, by having a Bony Substance, as the *Patella*, placed between them and the Insertion of their Tendon, their Line of Direction is farther removed from the Center of Motion, and consequently they act with greater Strength in antagonizing the Benders, than they could otherwise have done.



CHAP. XXXIV.
Of the MUSCLES of the FOOT, or TARSUS.



THE Foot has seven Muscles properly employ'd in its Motions, among which is reckon'd the *Plantaris*: But *Columbus* *, *Falloppius* †, and other Anatomists, reckon eight Muscles belonging to each Foot, rejecting *Vesalius* his ninth, it being part of the *Extensor Digitorum Longus*, that is inserted into the Metatarsal-Bone of the little Toe. Notwithstanding which we choose to follow ‡ *Spigelius*, ** *Veslingius*, and the later Authors, making of their two first the *Gastrocnemius Externus* and *Gastrocnemius Internus* only one Muscle, giving it the Name of *Gastrocnemius Externus*, and calling its subjacent Muscle *Gastrocnemius Internus*, which former Anatomists had named *Soleus*.

* *Lib. 5. Cap. 30.*

† *Observat. Anatom.*

‡ *Lib. 4. cap. 24.*

** *Cap. 19.*

CLXX.

Tab. LV.
LVI. LXI.

TIBIALIS ANTICUS.

SO called from its Situation on the fore part of the *Tibia*; also by *Spigelius* called *Musculus Catene*, because, when it is divided, the Patient is forced to use a Sling to support the Foot in walking. Its Origination is fleshy from the lower part of the superiour Appendage of the *Tibia*, between its Prominence, where the great Tendon of all the extending Muscles of the Leg is inserted, and the Origination of the *Musculus Extensor Magnus Digitorum Pedis*: It also continues a disgregated fleshy Origination from near two thirds of the superiour part of the said *Tibia* externally and laterally, next the *Fibula*; which composing a fleshy Belly, lessens itself in half its Progress; and growing into a strong and somewhat round Tendon, descends obliquely over the inferiour part of the *Tibia*, and under the annular Ligament, and is inserted partly into the inside of the *Os Cuneiforme Majus*, but chiefly into the *Os Metatarsi Pollicis*.

THIS pulls the Foot upwards and forwards directly.

CLXXI.

Tab. LV.
LXII.

GASTEROCNEMIUS EXTERNUS, seu GEMELLUS.

SO called, because with the *Soleus*, or *Internus* of the same Name, it composes the Calf of the Leg: It is also called *Gemellus*, from its being as it were double. It has two distinct fleshy Originations, from the superiour and hindmost Parts of each Tubercle of the lower Appendage of the Thigh-Bone, which in their Descent are dilated into two large fleshy Bellies, the innermost of which is thickest and largest, having each a differing Series of fleshy Fibres, and joining to each other near where they make a broad strong Tendon, which narrowing it self, joins with the great Tendon of the *Gastrocnemius Internus*, four Fingers breadth above its Insertion into the *Os Calcis*.

RIOLAN * asserts, with *Vesalius*, that in the two Beginnings of this Muscle there are two *Officula Sesamoidea*, which we must acknowledge with *Marchette* have hitherto escaped our Observation, tho' its likely it may be so in aged Bodies, as it appear'd in a Subject I lately dissected on one side only.

WHEN this Muscle acts, the Foot is said to be extended, or pulled backwards; which Motion of it is very necessary in Walking, Running, Leaping, and standing on Tiptoe, &c. Hence it is, those that walk much, have these Muscles larger than others, through the frequent use of them, among which those that carry heavy Burthens, and especially Sedans or Chairs in this Town; and those, who wear low-heeled Shoes, have these Muscles remarkably larger than others.

* Lib. 5. Cap. 43.

CLXXII.
PLANTARIS.Tab. VIII.
LXII.
LXV.

SO called from its Tendon expanded in the *Planta Pedis*, like that of the *Palmaris* in the Palm of the Hand. It arises fleshy from the superiour and back part of the outermost Tubercle of the lower Appendage of the Thigh-Bone, immediately under the external Beginning of the former Muscle; and descending obliquely between it and the following Muscle, soon becomes a thin flat Tendon, which passing out from between their fleshy Bellies, descends internally laterally by their great Tendon; and marching close over the *Os Calcis*, joins with other Tendons arising from the *Os Calcis*; all which expand themselves on the Sole of the Foot, where they firmly adhere to the fleshy Body of the *Musculus Flexor Digitorum Perforatus*; some of them ending on the upper Parts of the *Ossa Metatarsi*, and others on both sides the Extremities of these Bones, where the Toes are articulated.

WHEN this Muscle acts, it assists the *Gastrocnemii*, and its tendinous Expansion on the bottom of the Foot serves to defend the subjacent Muscles, Tendons, Nerves, and large Blood Vessels, from being too much compress'd in standing, walking, &c. I have frequently observ'd the fleshy Beginning and long Tendon of this Muscle to be wanting.

BESIDES this tendinous Expansion on the bottom of the Foot, I lately observ'd a small Tendon, or Ligament, arising from the *Os Metatarsi* of the little Toe, and fastned to the Bone of the same Name, that supported the middle Toe; but in this Foot there was no *Musculus Transversalis*.

CLXXIII.

SOLEUS, seu GASTROCNEMIUS INTERNUS.

Tab. V. VII.
VIII. LV.
LXII.

THIS is placed under the two former Muscles. Its external fleshy Part is cover'd with a transparent tendinous Expansion, which makes it appear of a livid Colour. Its Beginning is partly tendinous, but chiefly fleshy, from the hindmost part of the upper *Appendix* of the *Fibula*, and back part of the *Tibia*, below the Insertion of the *Subpopliteus*, and increases to a large fleshy Belly, composed of various Orders of fleshy Fibres, some of them underneath aptly expressing the Figure of the top of a Feather, whose *Stamina* here being tendinous, join with the great Tendon, which is about four Fingers breadth in Length, and inserted into the superiour and hindmost part of the *Os Calcis*.

THE Foot, together with the Toes, being as it were a Leaver to the whole Body, ought therefore to be attended with Muscles of great Strength to extend it; wherefore we find these Muscles so much to exceed their Antagonist the *Tibialis Anticus*, as well in the advantageous Construction of their differing Series of fleshy

E c

Fibres,

Fibres, as their Magnitude, the *Tibialis* weighing only five Ounces and a Quarter, whereas the two *Gastrocnemii* weigh one Pound ten Ounces; whereby they are not only render'd serviceable in Walking, Running, Leaping, &c. but do also support the *Tibia* in Standing, lest the superincumbent Pressure of the Weight of the Body should make them incline forwards, at their Articulations with the *Talus*.

CLXXIV.

PERONÆUS PRIMUS.

Tab. V. VIII.
IX. LV. LVI.
LXII. LXVI.

BY some called *Longus*, it being the longest Muscle seated on the *Fibula*, or *Os Perone*. It arises externally tendinous, and fleshy internally, from above half the superiour part of the said Bone; and marching somewhat backwards, becomes a strong, flat Tendon, four Fingers breadth in Length above the inferiour Appendage of the *Fibula* called *Malleolus Externus*, passing behind which in a Chancel, like a Rope in a Pulley; and from thence being inflected forwards, together with the Tendon of the following Muscle, they both pass under an imbanding Ligament, as they run over the *Os Calcis*; but this Tendon declining from its Companion, marches over the *Os Cuboides*, under the *Musculus Abductor Minimi Digiti*, over the *Ossa Cuneiformia* in the bottom of the Foot, and under the Tendons and Muscles bending the Toes, and is inserted into the superiour and hindmost part of the *Os Metatarsi* of the great Toe.

Tab. LXII. IN the Tendon of this Muscle is found a Bony Substance, which moves on the
N. *Os Cubiforme*, not unlike the *Patella* of the Knee.
Tab. LXVI.

THE Passage of the Tendon of this Muscle over the hindmost part of the *Malleolus Externus*, as on a Pulley, is an elegant contrivance in Nature, whereby the Ball of the great Toe (as that part is commonly called, to which it is inserted) is directed towards a perpendicular bearing of the weight of the Body on the Leg, in standing on Tiptoe.

CLXXV.

PERONÆUS SECUNDUS.

Tab. V. LV.
LVI. LXII.

BY some called *Semi-fibulæus*: It has an acute fleshy Beginning above the middle of the external part of the *Fibula*, under the fleshy Belly of the former Muscle; it also continues its fleshy Beginning from the posteriour sharp edge of the *Fibula*, and becoming a fleshy Belly grows tendinous, as it runs under the *Malleolus Externus*, together with the Tendon of the former Muscle, and is inserted into the superiour and external part of the *Os Metatarsi* of the little Toe.

THE proper Action of this Muscle is to pull the Foot and Toes outwards.

CLXXVI.

TIBIALIS POSTICUS.

Tab. IX.
LVI. LXII.
LXVI.

THIS being placed on the back part of the *Tibia*, is also called *Musculus Nauticus*, because Mariners chiefly use it in climbing up the Masts of their Ships. It lies partly under the *Flexor Tertii Internodii Pollicis*, which Muscle must be partly raised, together with the *Flexor Tertii Internodii Digitorum Pedis*, before we can have a clear Sight of it. It appears Biventral, arising partly tendinous and partly fleshy from the superiour and back part of the *Fibula*, as also from the Ligament that is continued between the said Bone and the *Tibia*; in near half its Progress it becomes less, and grows fleshy again, making a strong, flat Tendon, which runs in a *Sinus* on the back part of the lower Appendage of the *Tibia*, called the *Mal-leolus Internus*, under an annular Ligament, over the *Os Naviculare*, to which it is tack'd down by some tendinous Fibres, and ends internally and laterally on the *Os Cuneiforme Majus*.

THIS draws the Foot upwards and inwards.

IN the Tendon of this Muscle, as in that of the *Peroneus Primus*, I have frequently found a Bony Body, just where it marches over the *Os Naviculare*.





CHAP. XXXV.

Of the MUSCLES of the GREAT TOE.



THE great Toe is moved by its proper Muscles, which we reckon to be six in number, namely, *Extensor Pollicis Longus*, and *Extensor Brevis*, *Flexor Pollicis Longus*, and *Flexor Brevis*, *Adductor* and *Abductor Pollicis*. Though Anatomists commonly mention but four of these, yet we have observ'd them in several Dissections to be so many distinct Muscles, as they are accurately figured in *Bidloo* *. To these may be added the *Musculus Transversalis Placentini*,

which our above-mention'd Author and some other make to be an *Adductor Pollicis*; but we take it rather to be an *Adductor Minimi Digiti*, wherefore it shall be described in the following Chapter.

CLXXVII.

EXTENSOR POLLICIS LONGUS.

Tab. I. II.
V. LVI.
LXIII.

THIS Muscle doth not arise, as most describe it, from the *Tibia*, or from the Ligament between it and the *Fibula*. Its Beginning is large and fleshy from the fore part of the *Fibula*, from immediately below its superiour *Appendix*, to four Fingers Breadth above the inferiour one, and descending under the *Ligamentum Annulare* of the *Tarsus*, between the Tendon of the *Tibialis Anticus* and those of the *Extensor Digitorum Pedis Longus*, and marching along the superiour part of the Foot, it is inserted into the upper part of the second Bone of the great Toe.

ITS Name intimates its Use.

THIS Muscle, just where it passes under the annular Ligament, sends off a small Tendon, which is inserted into the upper part of the first Bone of the great Toe externally and laterally, as has been frequently observ'd and demonstrated by that inquisitive and accurate Anatomist, Mr. *Joseph Tanner*.

* Tab. 81. & 82.

CLXXVIII.

EXTENSOR POLLICIS BREVIS.

Tab. I. VI.
LV. LVI.
LXIII.

THOUGH this Muscle is not mentioned by Anatomists, yet we constantly observe it in Dissection. It hath been commonly taken for part of the *Extensor Digitorum Brevis*; but we frequently find it distinct.

It ariseth fleshy from the fore part of the *Os Calcis*, and being dilated into a fleshy Belly, soon becomes a long, slender Tendon, passing obliquely over the upper part of the Foot, and is inserted into the superiour part of the first Bone of the great Toe, which it extends or pulls upwards.

CLXXIX.

FLEXOR POLLICIS LONGUS.

Tab. VIII.
LVI. LXIII.
LXV. 4. 4.
LXVI.

THIS is an Antagonist to the *Extensor Longus*; arising opposite to it from the back part of the *Fibula*, with a double Order of fleshy Fibres, running to a middle Tendon, like the *Flexor Tertii Internodii Pollicis Manus* above. It ceaseth to be fleshy as it passes over the Juncture, and runs through a Chanel on the internal part of the *Os Calcis*, under the Tendon of the *Musculus Flexor Digitorum Longus Perforans*, to which Tendon it sends off a fleshy Slip over the following Muscle, and is inserted into the upper end of the second Bone of the great Toe.

CLXXX.

FLEXOR POLLICIS BREVIS.

Tab. LXIV.
LXV. LXVI.

IS short, thick, and fleshy, seemingly divided into two Muscles by the Tendon of the former passing over it. It ariseth from the superiour part of the *Os Cuneiforme medium*, and running over the Termination of the *Musculus Peronæus Primus*, is implanted into the *Offa Sesamoidea* of the great Toe, which are likewise tied to the superiour part of the second Bone of that Toe.

CLXXXI.

ADDUCTOR POLLICIS.

Tab. LXIV.
LXVI.

THIS is describ'd and figur'd by * *Veslingius*, and also mention'd by *Marchette*. It arises with a broad, flat Tendon, from the *Os Calcis*, immediately under the *Musculus Communis Lumbricalis*, and in half its Progress on the bottom of the Foot, it becomes fleshy, just after it passes over the Tendon of the *Peronæus Longus*, where it meets with another Beginning partly fleshy, and partly

* Cap. 19.

Of the MUSCLES of the GREAT TOE.

tendinous, from the inferiour part of the *Os Cuneiforme Tertium*; after which it marches obliquely to its Insertion into the inner *Os Sesamoideum* of the great Toe.

THIS draws the great Toe nearer to the rest.

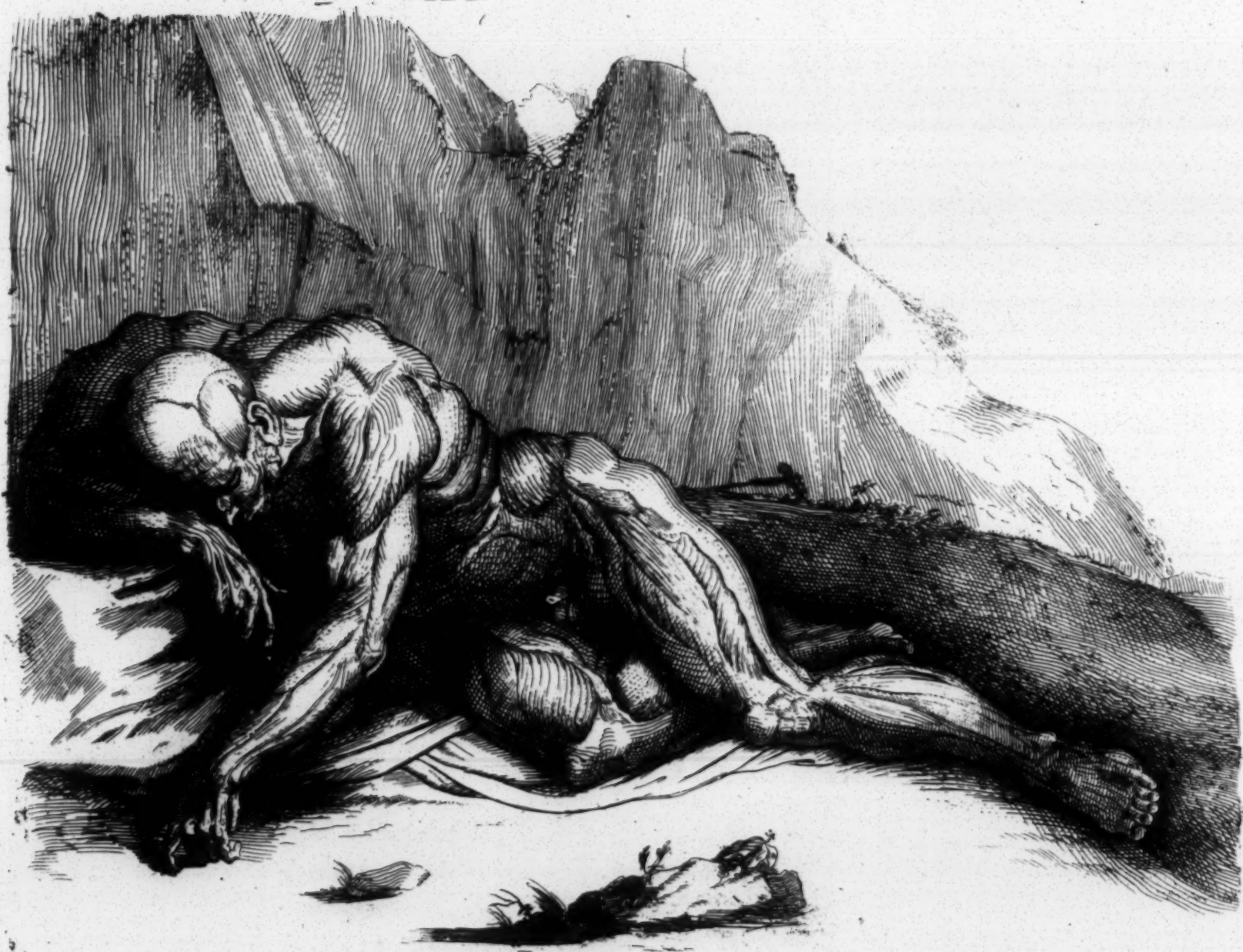
CLXXXII.

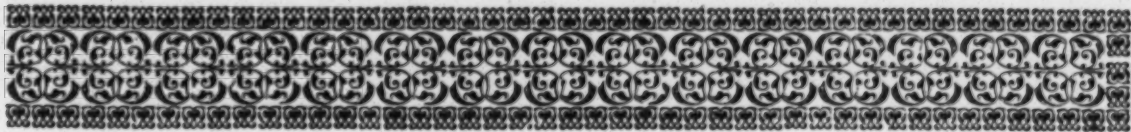
ABDUCTOR POLLICIS.

Tab. LXIV.
LXV.

THIS ariseth fleshy from the *Os Calcis* internally and laterally; in half its Progress becoming tendinous, it joins with another fleshy Beginning, springing from the *Os Cuneiforme Majus*; both which making one Tendon, join with the *Flexor Pollicis Brevis*, before they are inserted into the external part of the first Bone of the great Toe laterally.

THIS pulls the great Toe from the rest.





CHAP. XXXVI.

Of the MUSCLES of the FOUR LESSER TOES.



THESE (like the Muscles of the Fingers) we shall divide into *Common* and *Proper*.

THE *Common* Muscles of the Toes are such, as have their Tendons inserted into all the lesser Toes, as the *Extensor Digitorum Pedis Longus*, *Extensor Brevis*, *Perforatus*, and *Perforans*. The rest are the *Proper* Muscles of the Toes, namely, *Lumbricales*, *Abductor Minimi Digiti*, *Transversalis Placentini*, *Flexor Primi Internodii Minimi Digiti Proprius*,

and the *Interossei*. Of these in their Order.

CLXXXIII.

EXTENSOR DIGITORUM PEDIS LONGUS.

Tab. II. V.
LV. LVI.
LXIII.

THIS hath an acute fleshy Beginning externally from the inferiour part of the upper *Appendix* of the *Tibia* next the *Fibula*; as also a long fleshy one from the superiour part of the last named Bone; and lessening it self in half its Descent on the Leg, it joins with a second, broad, disgregated fleshy Beginning, continued for near half the inferiour part of the said *Fibula*; where descending under the *Ligamentum Annulare* of the *Talus*, it is divided into five Tendons, four of which are inserted into the third Bones of all the lesser Toes; the fifth into the superiour part of the *Os Metatarsi* of the little Toe, which Part of it *Vesalius** makes his ninth Muscle belonging to the Foot.

* *Lib. 2. Cap. 60.*

CLXXXIV.

EXTENSOR DIGITORUM BREVIS.

Tab. v. VI.
LV. LVI.
LXIII.

THIS is a short fleshy Muscle, lying under the Tendon of the former, on the Foot. It ariseth fleshy from the external and fore part of the *Os Calcis*, soon dilating it self to a fleshy Belly; which being divided into four fleshy Portions, becomes so many Tendons, passing over the upper part of the Foot, and joining with the Tendons of the former Muscle, as they pass to their Insertions into the third Bone of each of the lesser Toes.

CLXXXV.

PERFORATUS.

Tab. LXIII.
LXV.

SO called, because its Tendons are perforated, like those of the Fingers. It is also called *Flexor Secundi Internodii Digitorum Pedis*, from its Use, and *Sublimis* from its Situation. It springeth from the inferiour and internal Part of the *Os Calcis*, between the *Musculi Abductores* of the greater and lesser Toes. Dilating it self to a fleshy Belly, after it hath passed the middle of the *Planta Pedis*, it is divided into four fleshy Portions, which become so many Tendons, and are divided near their Terminations, to admit the Tendons of the following Muscle to pass through them to their Insertions; these being united again, pass underneath the other to their Implantations at the upper part of the second Bone of each lesser Toe.

CLXXXVI.

PERFORANS.

Tab. VIII.
LV. LVI.
LXIII. LXV.
LXVI.

SO called, because its Tendons run through the Fissures in the Tendons of the former: It is also called *Flexor Tertii Internodii Digitorum Pedis* from its Use. It hath an acute fleshy Origination from the back part of the *Tibia*, immediately under the *Musculus Subpopliteus*, having a double Order of Fibres united in a middle Tendon, like the *Flexor Pollicis Longus*, but ceaseth to be fleshy, as it passeth behind the *Malleolus Internus*; and running in a Chancel over the internal Part of the *Os Calcis*, under its imbanding Ligaments, in half its Progress through the sole of the Foot, it is divided into four Tendons, which march through the Perforations of the Tendons of the former Muscle, and are inserted into the third Bone of every lesser Toe.

CLXXXVII.

CLXXXVII.

LUMBRICALES.

Tab. LXIII.
LXV. LXVI.
5, 6.

SO called from their Figure, like those of the Hand. Though Anatomists have generally describ'd them as arising from the Tendons of the last treated of Muscle, yet we rather think the *Carnea Massa* in the *Planta Pedis* is their true Origine. It springs from the internal Part of the *Os Calcis*, and becoming tendinous, joins with the Tendons of the former Muscle, in the middle of the Sole of the Foot; then dividing it self into four (as it were) distinct fleshy Muscles, they all become tendinous at their Insertions into the internal Parts of each lesser Toe laterally, next the great Toe.

CLXXXVIII.

ABDUCTOR MINIMI DIGITI.

Tab. LV.
LXIV. LXV.

ARISES outwardly tendinous, and inwardly fleshy, from the external part of the *Os Calcis*; and becoming entirely tendinous in half its Progress on the bottom of the Foot, passes over a small fleshy Muscle, which I call *Flexor Primi Internodii Minimi Digiti Proprius*, and is afterwards inserted into the first Bone of the little Toe externally and laterally.

CLXXXIX.

TRANSVERSALIS PEDIS.

Tab. LXIV.

SO called from its transverse Situation. It arises tendinous from the internal *Os Sesamoïdes* of the great Toe; and becoming a fleshy Belly in its Progress over the Metatarsal Bones of the two next Toes, grows broader, where it joins with a tendinous Ligament springing from the *Os Calcis*, and is inserted into a Cartilage on the first Articulation of the third lesser Toe, sending some fleshy Fibres likewise to the little Toe.

Its Use is to bring the lesser Toes nearer to the great Toe.

CXC.

FLEXOR PRIMI INTERNODII MINIMI DIGITI
PROPRIUS.

Tab. LXIV.
LXV.

IS a short fleshy Muscle, springing from the *Os Metatarsi Minimi Digiti*, and passing directly to its Insertion into the first Bone of the little Toe. In its Tendon are contained two *Ossa Sesamoidea*.

THOUGH this is a distinct Muscle, it has been commonly look'd on as a part of the *Abductor Minimi Digiti*; but, if you raise the last named Muscle from its Origine, you will not find any Connexion between it and this.

CXCI.

INTEROSSEI PEDIS.

Tab. LXIV.
LXVI.

ARE eight small fleshy Muscles, arising from the *Offa Metatarsi* of the lesser Toes. These are all alike in their Origine, Progress and Insertion, filling the concave inferiour Surface of the Metatarsal Bones. Each of them becoming a Tendon, which has an *Os Sesamoides* placed in it, unites with its Fellow on the opposite Side, having one common insertion into the superiour and under part of the first Internode of the Toe.

WHEN these Muscles act together, they bend the Toes: When they act separately, those that are placed on the inside of each lesser Toe, draw the lesser Toes towards the great Toe, and the opposite ones pull them the contrary way.



EXPLANATION

OF THE

TABLES.



T A B. I.

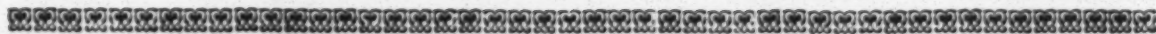
Represents the Muscles appearing on the fore Side of a human Body, after the external Teguments are removed.

- a* The Parotide Gland.
c The Maxillary Gland.



T A B. II.

The same Body, with some of the external Muscles raised, and others taken off.

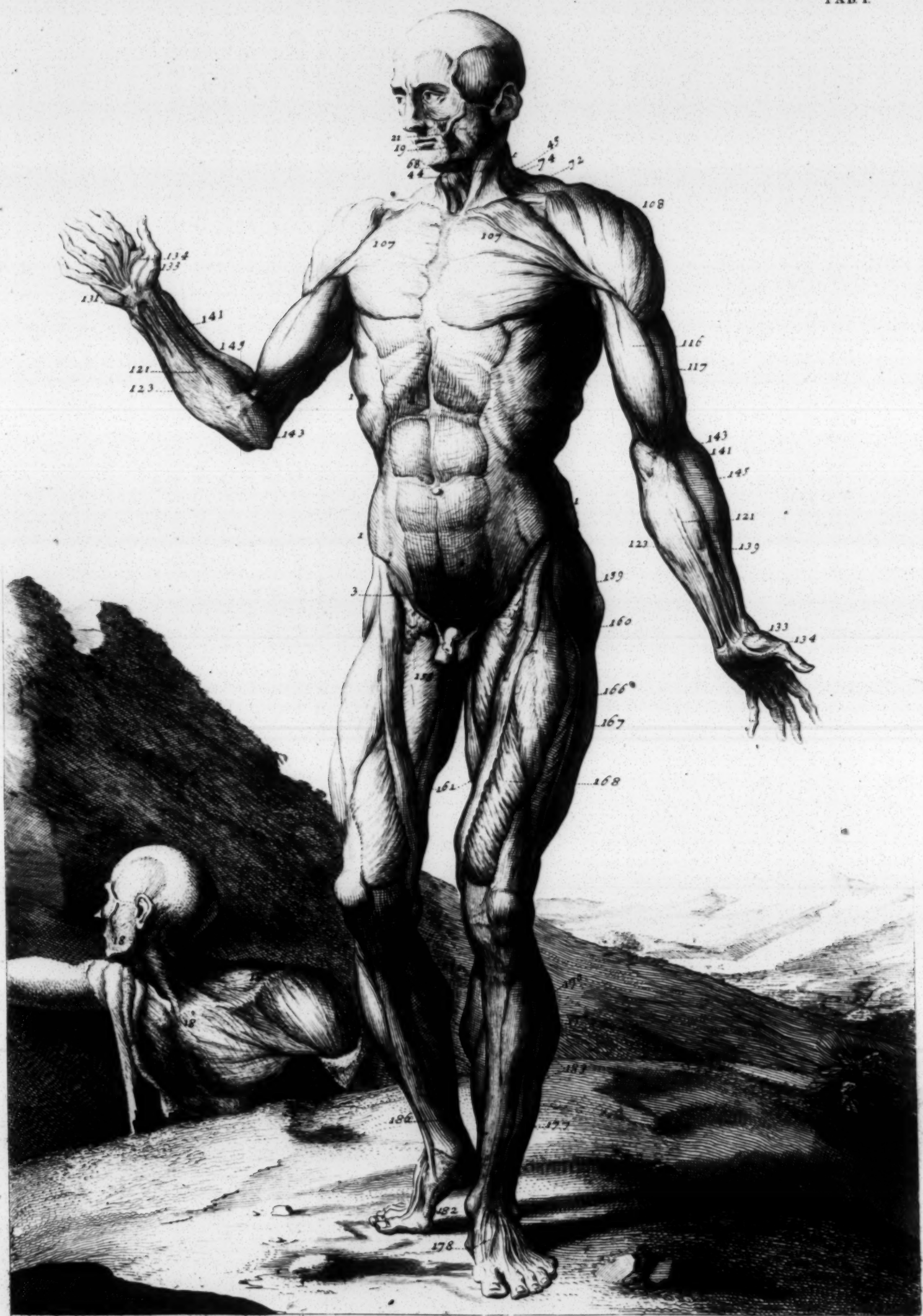


T A B. III.

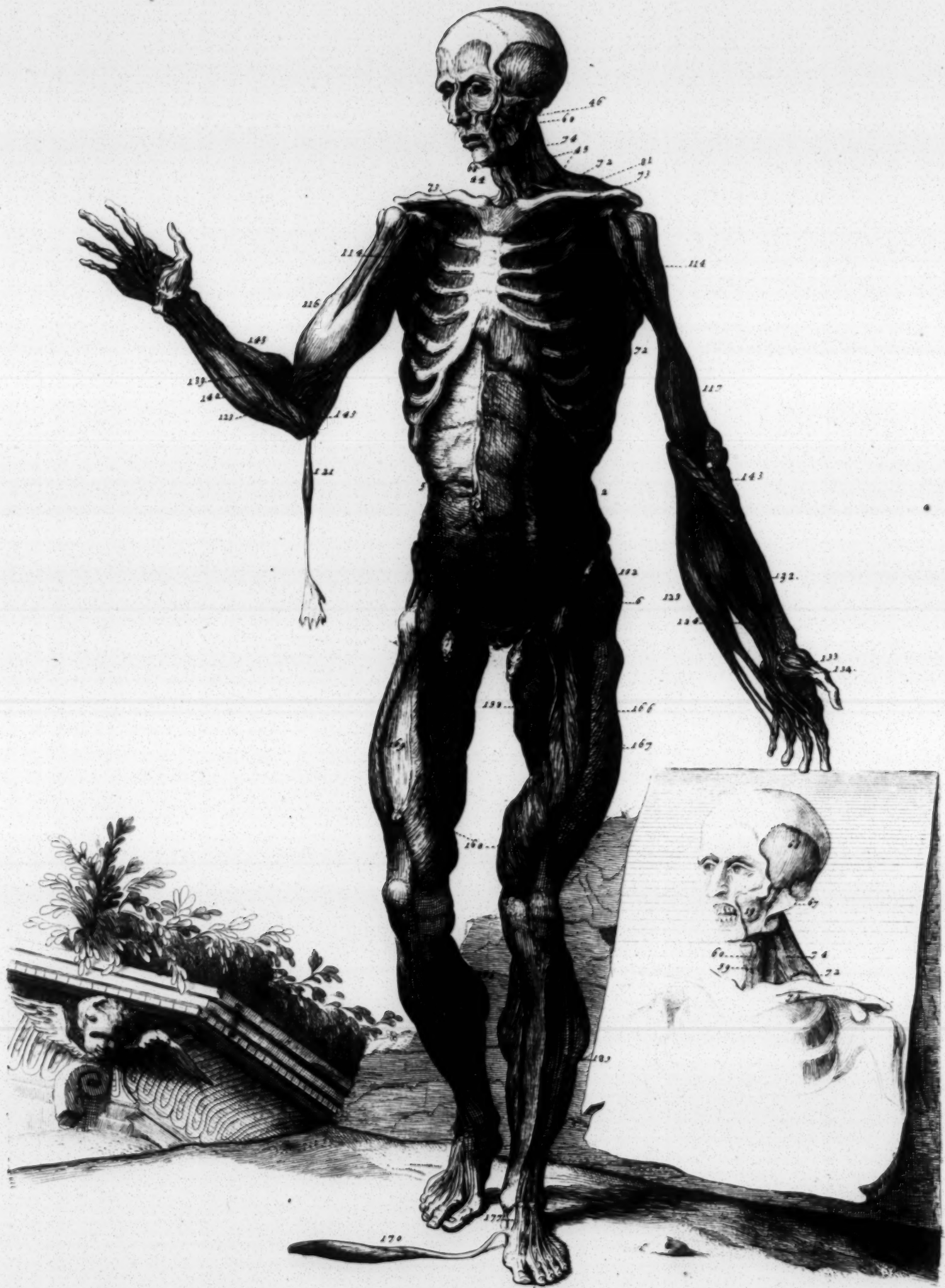
Shews the same Body farther denuded.

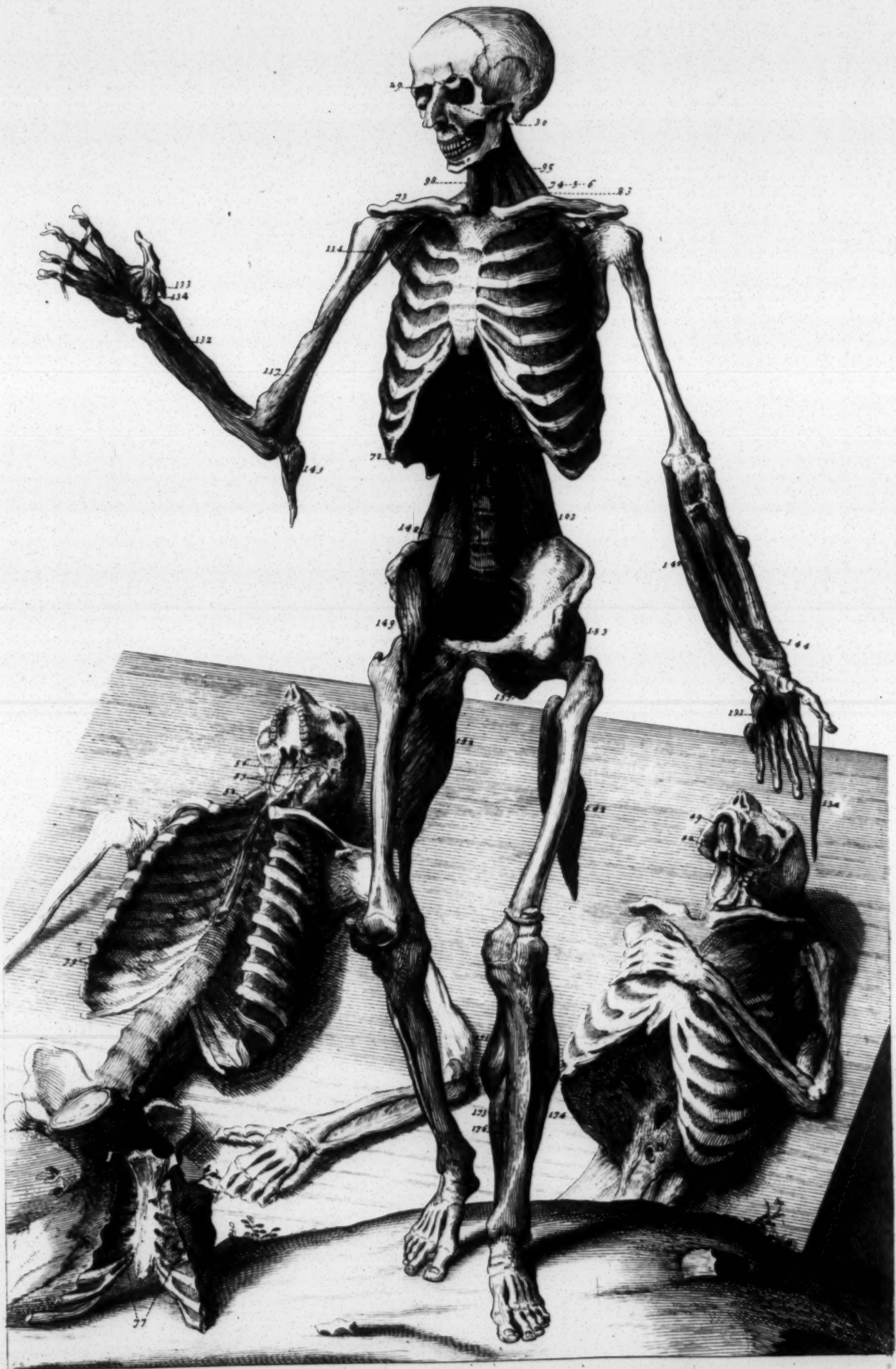
- A *a* B Three Perforations in the Diaphragm, for
 A The *Vena Cava*,
a The *Oesophagus*,
 B The *Aorta*.

TAB. I.

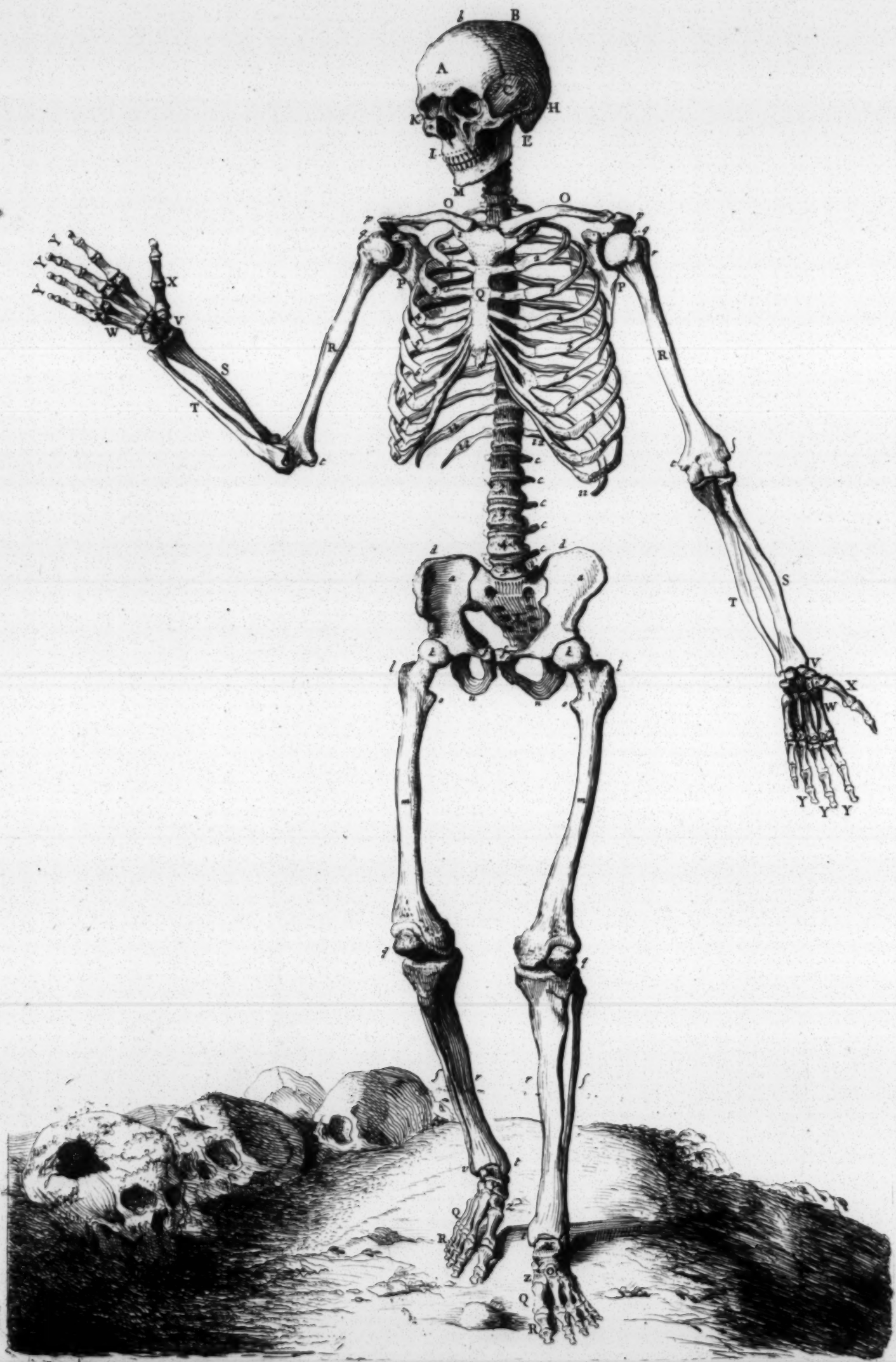


TAB. II.





TAB. IV.



TAB. IV.

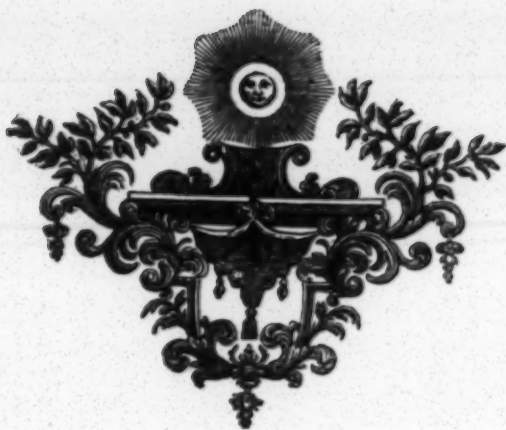
Shews the fore Part of the Skeleton of a Man.

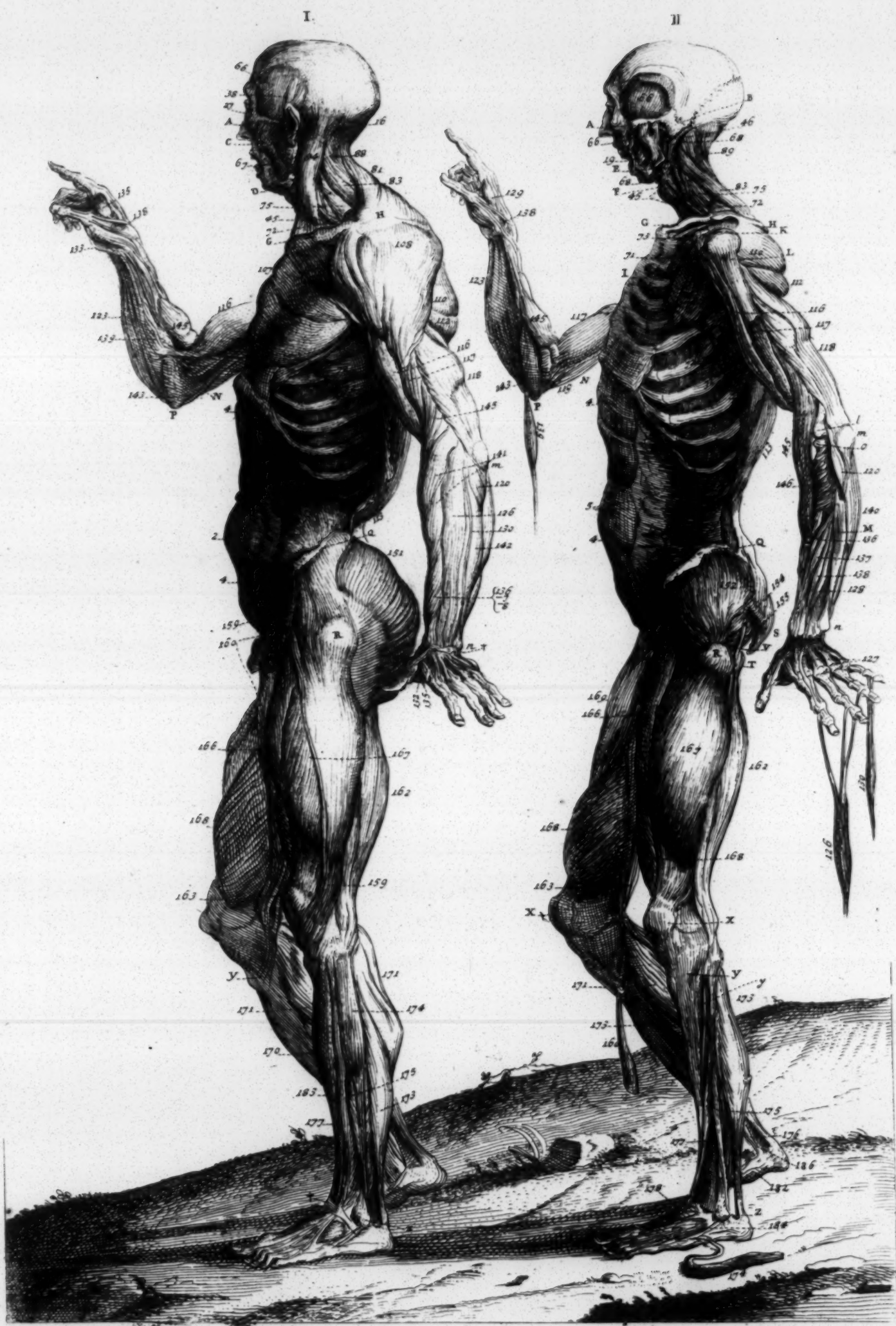
- A *Os Frontis.*
 B *Os Sincipitis.*
 b The meeting of the Coronal and Sagittal Sutures.
 C *Os Temporum.*
 E The Mastoide Process.
 H *Os Jugale.*
 I The upper Jaw-Bone.
 K The Bones of the Nose.
 M The lower Jaw-Bone.
 O The Clavicle.
 P The Scapula.
 p *Acromium.*
 q *Processus Coracoideus.*
 Q *Sternum.*
 R *Os Humeri.*
 r A *Sulcus*, in which passes one of the Heads of the *Biceps*.
 f The outer Protuberance of the *Humerus*, from which arise the Muscles extending the Wrist and the Fingers.
 t The inner Protuberance, whence the Benders of the Wrist and Fingers arise.
 S The *Radius*.
 T The *Ulna*.
 V The Bones of the *Carpus*.
 W of the *Metacarpus*.
 X of the Thumb.
 Y of the Fingers.
 1, 2, 3, &c. The twelve Ribs.
 1, 2, 3, 4, 5. The *Vertebrae* of the Loins.
 c, c, c, c. Their transverse Processes.
 a *Os Ilium.*
 d Its Spine.
 b *Os Sacrum.*
 f *Os Pubis.*
 n *Ischium.*
 m The Thigh-Bone.
 k Its Head.
 l The great *Trochanter*.
 o The lesser *Trochanter*.
 q The *Patella*.
 r The *Tibia*.

H h

f The

- f* The *Fibula*.
i The inner Ankle.
v The outer Ankle.
x The *Astragalus*.
y *Os Naviculare*.
z *Os Cuneiforme*, that joins the *Os Metatarsi* of the great Toe.
O *Os Cuneiforme* of the second Toe.
Q The Bones of the *Metatarsus*.
R The Bones of the Toes.





TAB. V.

Represents the Body in a Side View.

FIG. I.

- A The *Os Jugale*.
- C The Parotide Gland.
- D The Submaxillary Gland.
- G The Clavicle.
- H The *Acromium*.
- m The *Olecranium*.
- n The lower Extremity of the *Ulna*.
- † The annular Ligament of the *Carpus*.
- N A large Branch of the Brachial Nerve, which passes in a Chancel on
- P The inner Protuberance of the *Os Humeri*.
- Q The Spine of the *Os Ilium*.
- R The great *Trochanter*.
- Y The Insertion of the *Sartorius*, *Gracilis*, and *Semitendinosus* in the *Tibia*.
- Z The lower *Appendix* of the *Fibula*, or the outer Ankle.
- * The lower *Appendix* of the *Tibia*, or the inner Ankle.
- † The Ligament, under which pass the Tendons of the *Tibialis Anticus*, and
Extensor Longus Digitorum Pedis.

FIG. II.

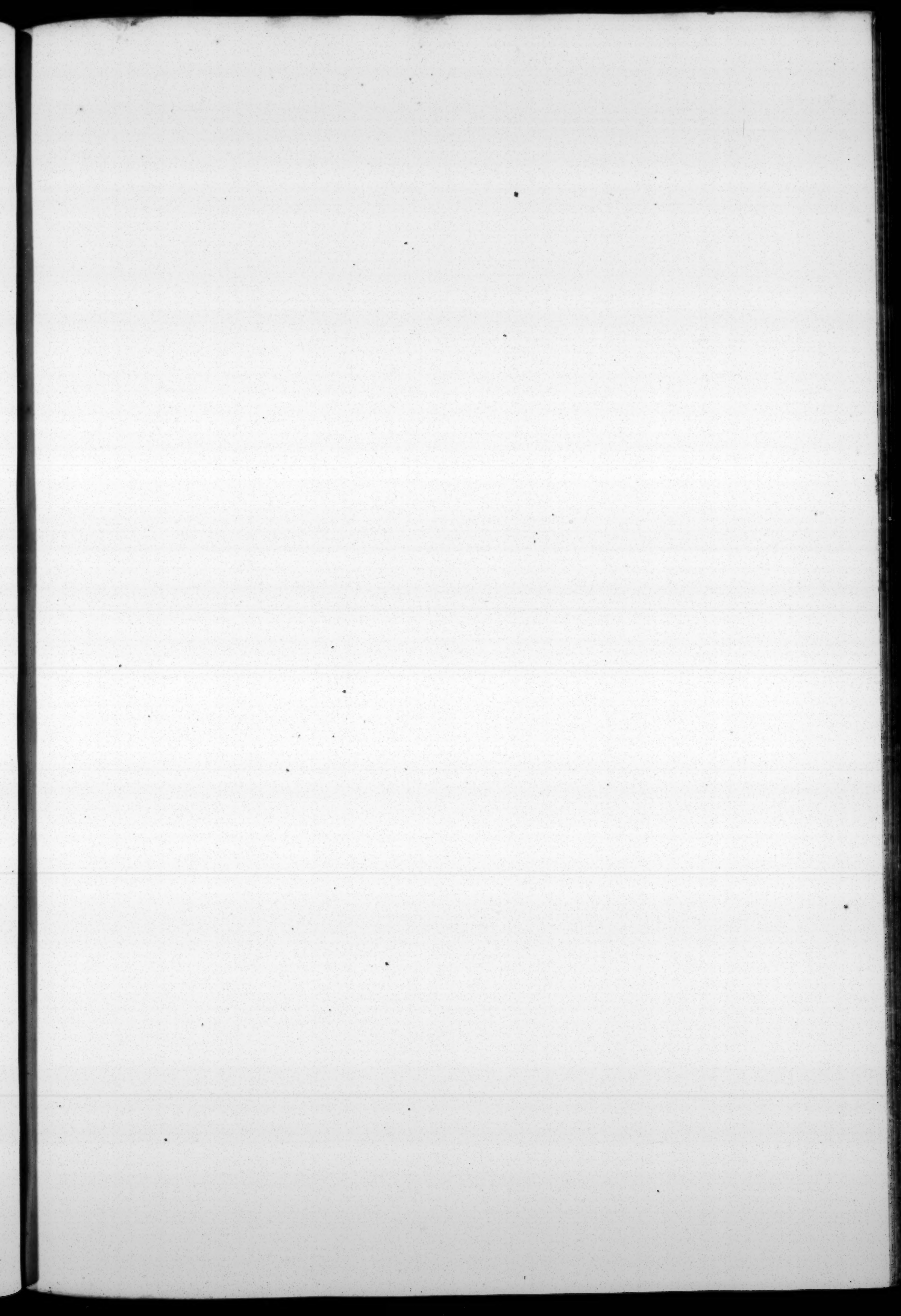
- A The *Os Jugale*.
- B The Mastoide Process bared.
- E Part of the lower Jaw laid bare.
- F The internal Jugular Vein.
- G The Clavicle.
- H The Spine of the *Scapula*.
- I The *Sternum*.
- K The *Processus Coracoideus*,
- L The upper Part of the *Os Humeri* laid bare.
- l The outer Protuberance of the *Humerus* bared.
- M Part of the *Ulna*.
- m The *Olecranium*.
- n The lower Extremity of the *Ulna*.
- o The Head of the *Radius*.
- N The Nerve, and
- P The *Sulcus*, as in the preceding Figure.

Q The

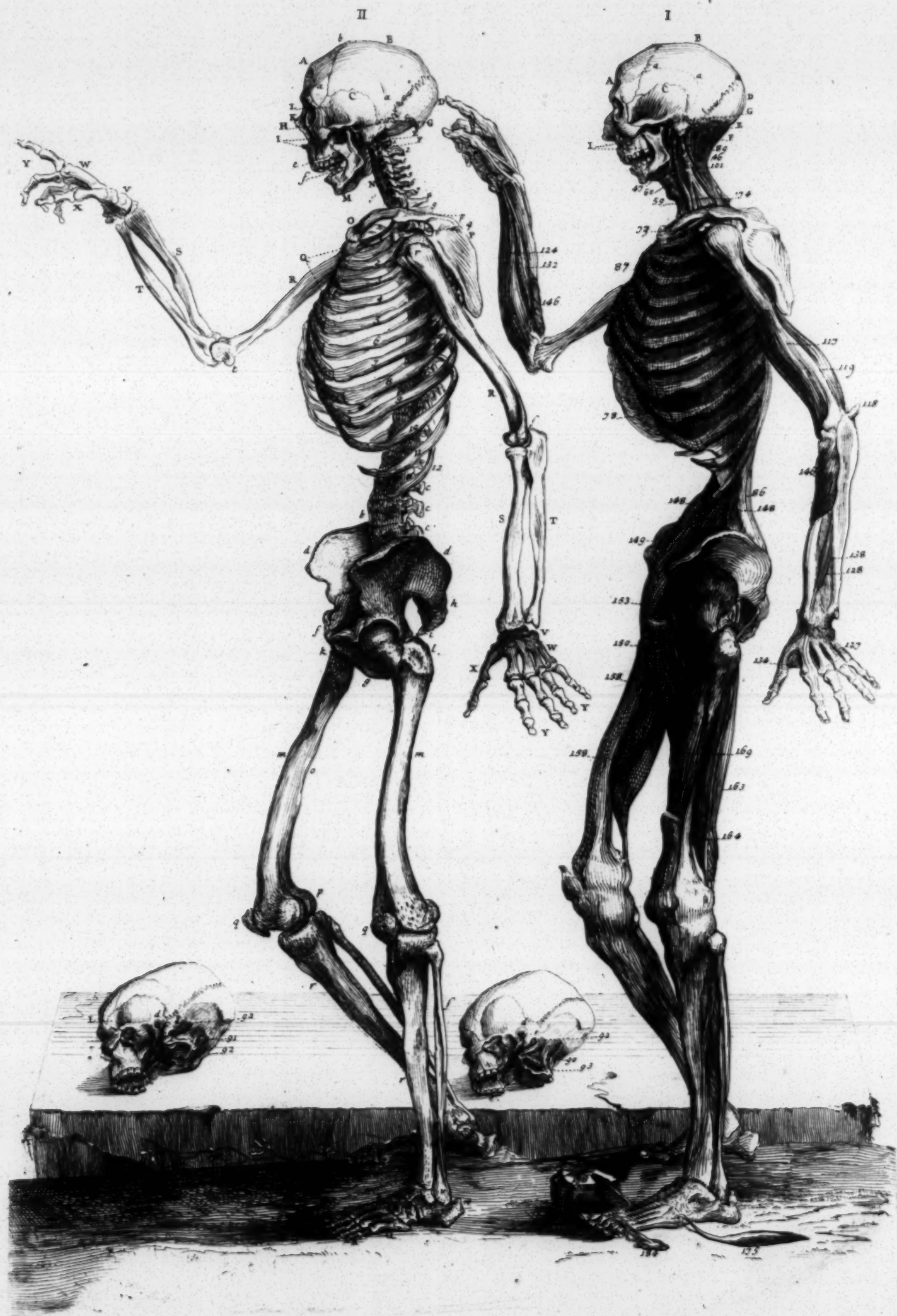
EXPLANATION *of the* TABLES.

- Q The Spine of the *Os Ilium*.
R The great *Trochanter*.
S The *Os Sacrum*.
T The obtuse Process of the *Iscium*.
V The Trunk of the crural Nerve.
X The *Patella*.
Y The upper Part of the *Tibia* bared.
y The Blood Vessels passing between the Bones.
Z The outer Ankle.
* The inner Ankle.





TAB. VI.



TAB. VI.

Represents the Side View of the Body partly demuded, and of the Skeleton.

FIG. I. II.

- A The *Os Frontis*.
- B The *Bregma*.
- C The *Os Temporale*.
- D The *Os Occipitis*.
- E *Processus Mammillaris*.
- F *Processus Styloides*.
- G *Meatus Auditorius*.
- I *Maxilla Superior*.

aa The semicircular Asperity of the *Os Bregmatis*, from which the temporal Muscle arises.

FIG. II.

- H *Os Jugale*.
- K *Os Nasi*.
- L Part of the Sphenoidal Bone.
- M The lower Jaw-bone.
- b* The Union of the Sagittal and Coronal Sutures.
- c* The Rife of the Occipital Muscle.
- e* The *Processus Corone*.
- f* The *Processus Condylodes*.
- N The Bodies of the *Vertebrae Colli*.
- 1, 2, &c. 9. Their Spinal Processes, with those of the two uppermost of the Back.
- O The *Clavicula*.
- P The *Scapula*.
- p* The *Acromium*.
- q* The *Processus Coracoides*.
- Q The *Sternum*.
- R The *Humerus*.
- r* The *Sulcus*, in which runs the Tendon of one Head of the *Biceps*.
- s* The outer Protuberance of the *Humerus*.
- t* The inner Protuberance.
- S The *Radius*.
- T The *Ulna*.
- V The Bones of the *Carpus*.
- W The *Metacarpus*.
- X The Bones of the Thumb.
- Y of the Fingers.

EXPLANATION of the TABLES.

- 1, 2, 3, &c. The twelve Ribs.
b The Bodies of the *Vertebrae Lumborum*.
c, c, c. Their Spinal Processes.
d The Spine of the *Os Ilium*.
f The *Offa Pubis*.
g The *Os Ischium*.
h The *Os Sacrum*.
i *Os Coccygis*.
k The Head of the *Os Femoris*.
l The great *Trochanter*.
m The Thigh Bone.
o The *Linea Aspera*.
p The lower *Appendix*, with its two Heads, from which the *Gasterocnemius*
 and *Soleus* arise.
q The *Patella*.
r The *Tibia*.
s The *Fibula*.
t The lower *Appendix* of the *Tibia*, or the inner Ankle.
v The lower *Appendix* of the *Fibula*, or the outward Ankle.
w The *Os Calcis*.
x The *Astragalus*.
y The *Os Naviculare*.
Z, O The *Offa Cuneiformia*.
p The *Os Cuboides*.
Q *Offa Metatarsi*.
R The Bones of the Toes.

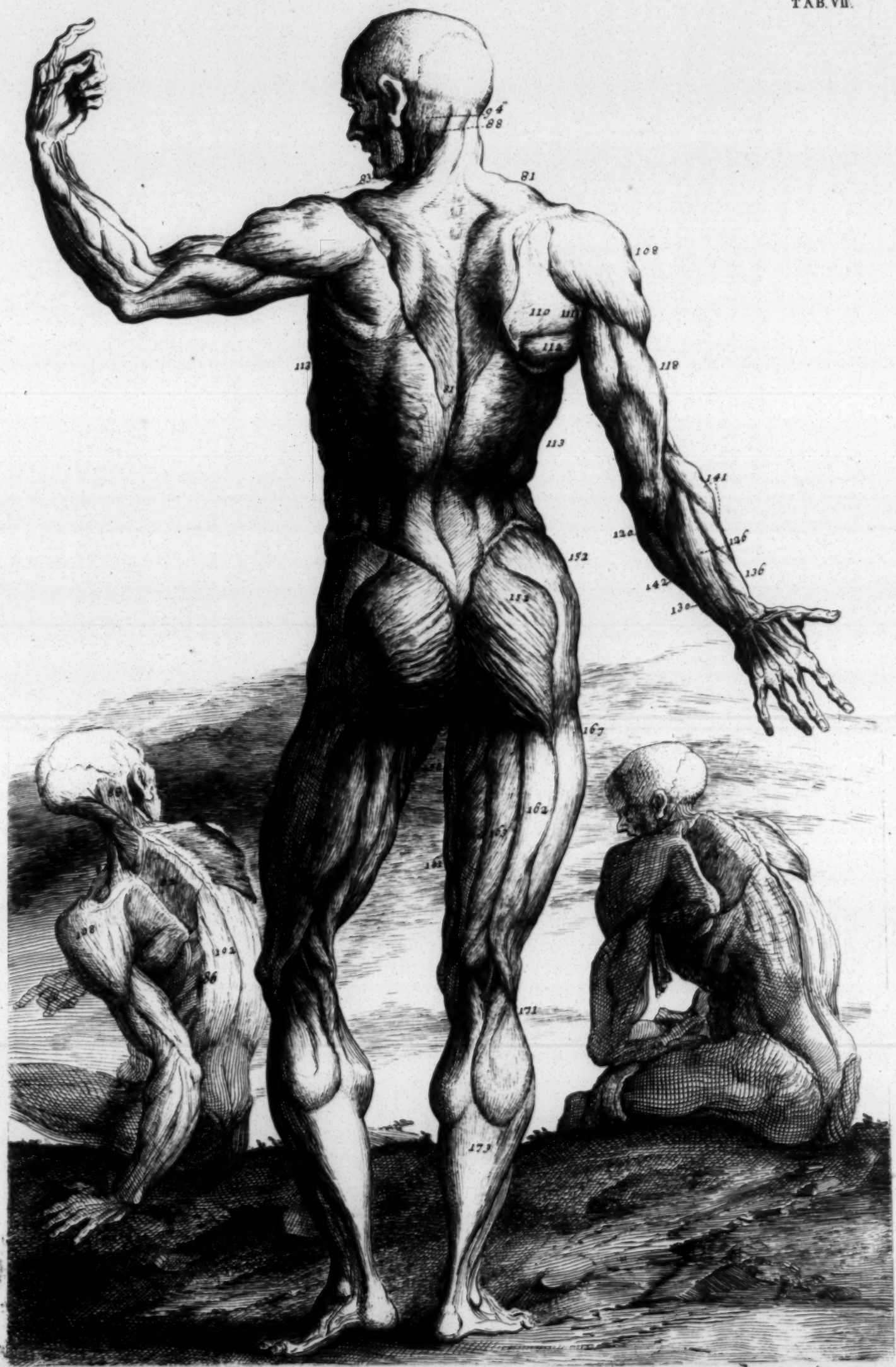
FIG. III. IV.

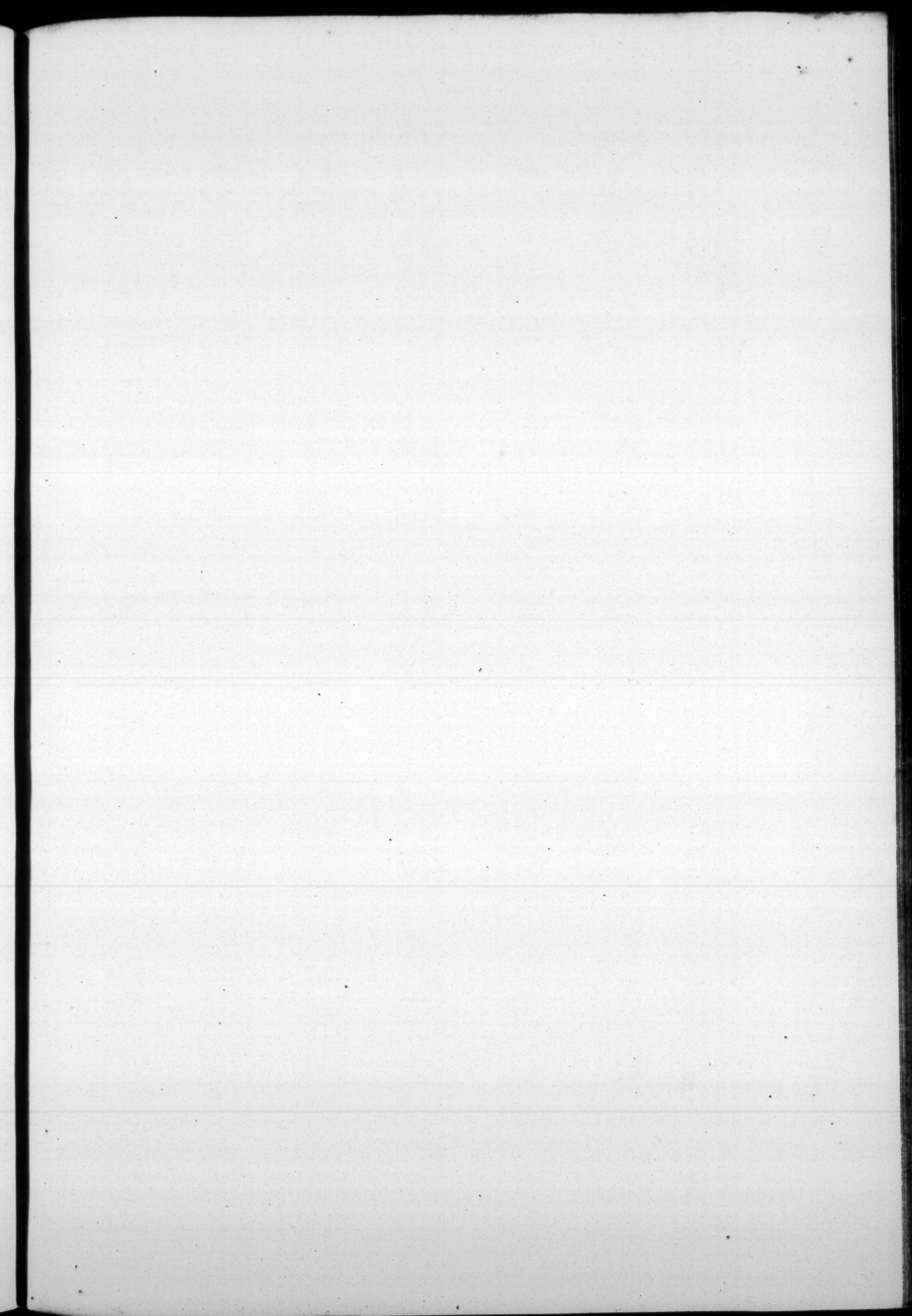
- L* Part of the Sphenoidal Bone.
d The *Meatus Auditorius*.



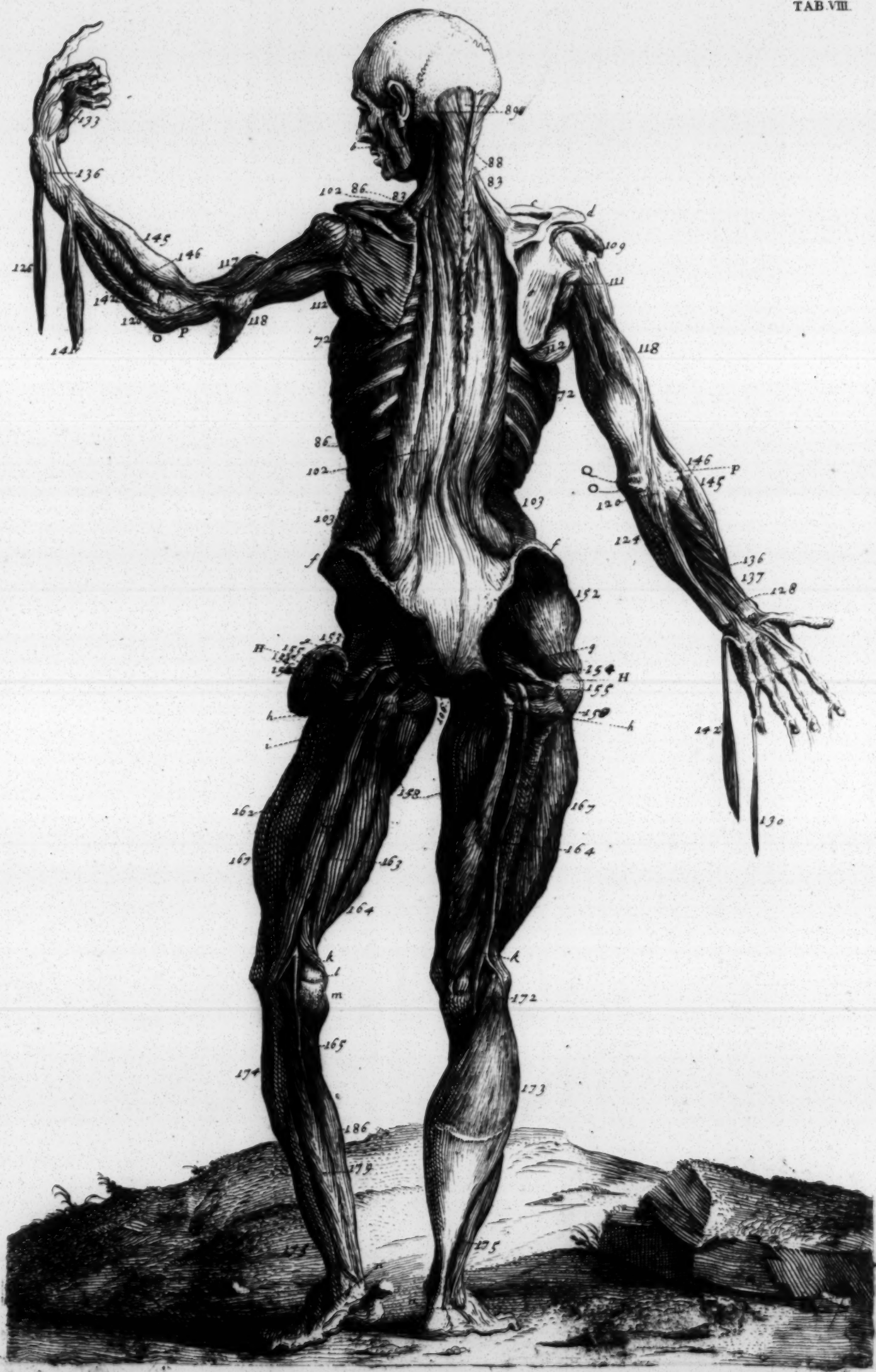
TAB.

TAB. VII.





TAB. VIII.



TAB. VII.

Shews the back View of the Body of a Man.

TAB. VIII.

The same Body with some of the external Muscles taken off.

- a* The Rise of the *Ligamentum Colli* from the *Os Occipitis*.
- b* The lower Jaw-bone partly bared.
- c* The *Clavicula*.
- d* The *Acromium*.
- e* The *Scapula*.
- O* The *Olecranon*.
- P* The outer, and
- Q* The inner Protuberance of the *Os Humeri*.
- f* The Spine of the *Os Ilium*.
- g* The Ligament between the obtuse Process of the *Ischium* and the *Os Sacrum*.
- H* The great *Trochanter*.
- h* The obtuse Process of the *Ischium*.
- i* Part of the *Os Ischium* laid bare.
- k* The Trunk of the Crural Nerve.
- l* The inner Head of the lower *Appendix* of the Thigh Bone.
- m* The Head of the *Tibia*.
- n* The outer Ankle.



TAB. IX.

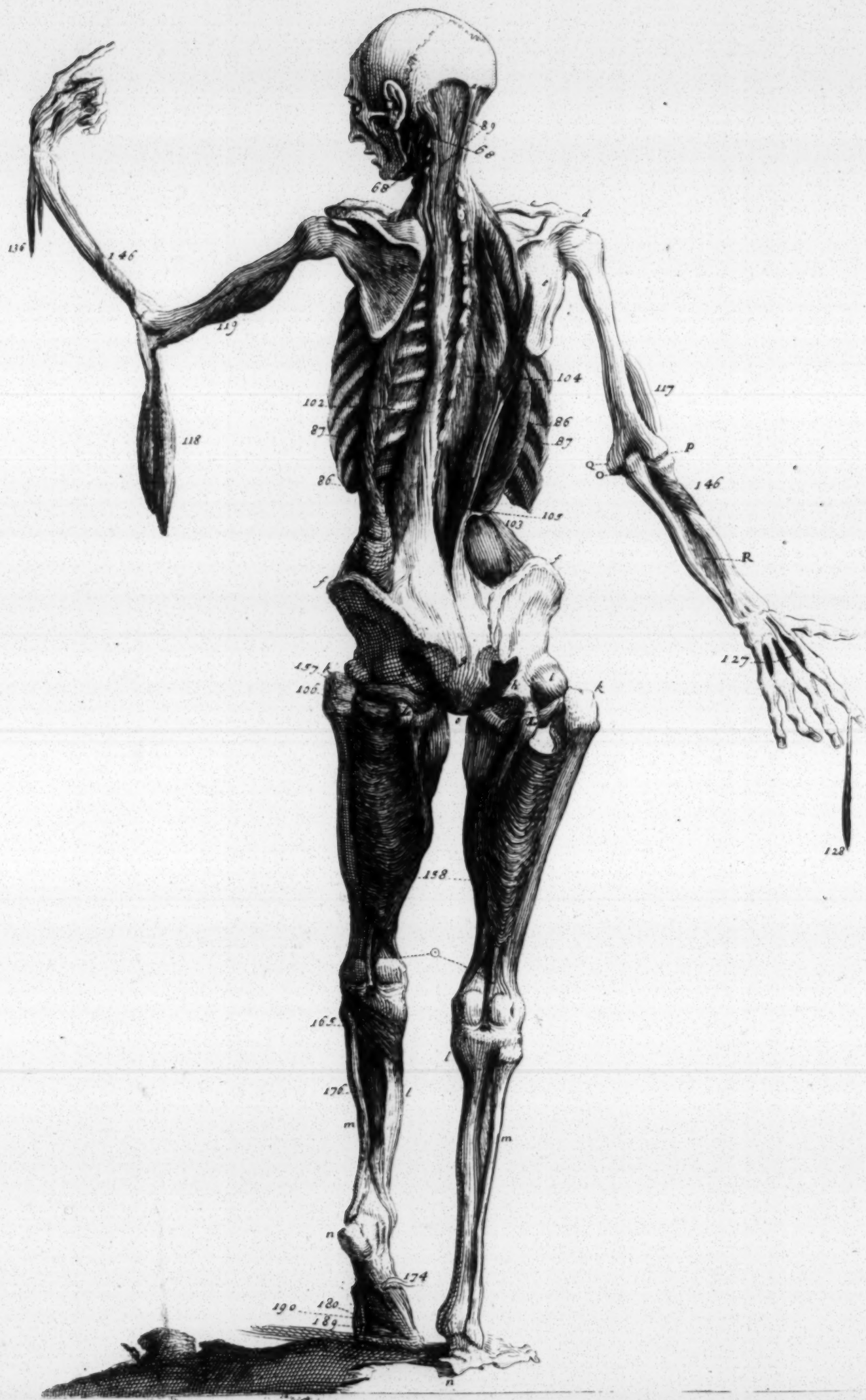
Represents the same Body, with more of the Muscles removed.

- a* The Rise of the *Ligamentum Colli* from the *Occiput*.
- c* The *Clavicula*.
- d* The *Acromium*.
- e* The *Scapula*.
- o* The *Olecranon*.
- P* The outer, and
- Q* The inner Protuberance of the *Humerus*.
- R* The Ligament between the *Radius* and *Ulna*.
- f* The Spine of the *Os Ilium*.
- h* The acute Process of the *Ischium*.
- L* The obtuse Process of the same Bone.
- g* The *Os Sacrum*.
- o* The *Os Coccygis*.
- i* The Head of the *Os Femoris* cover'd with the *Ligamentum Latum*.
- k* The great *Trochanter*.
- ⊙ The Crural Artery.
- l* The *Tibia*.
- m* The *Fibula*.
- n* The *Calcaneus*.

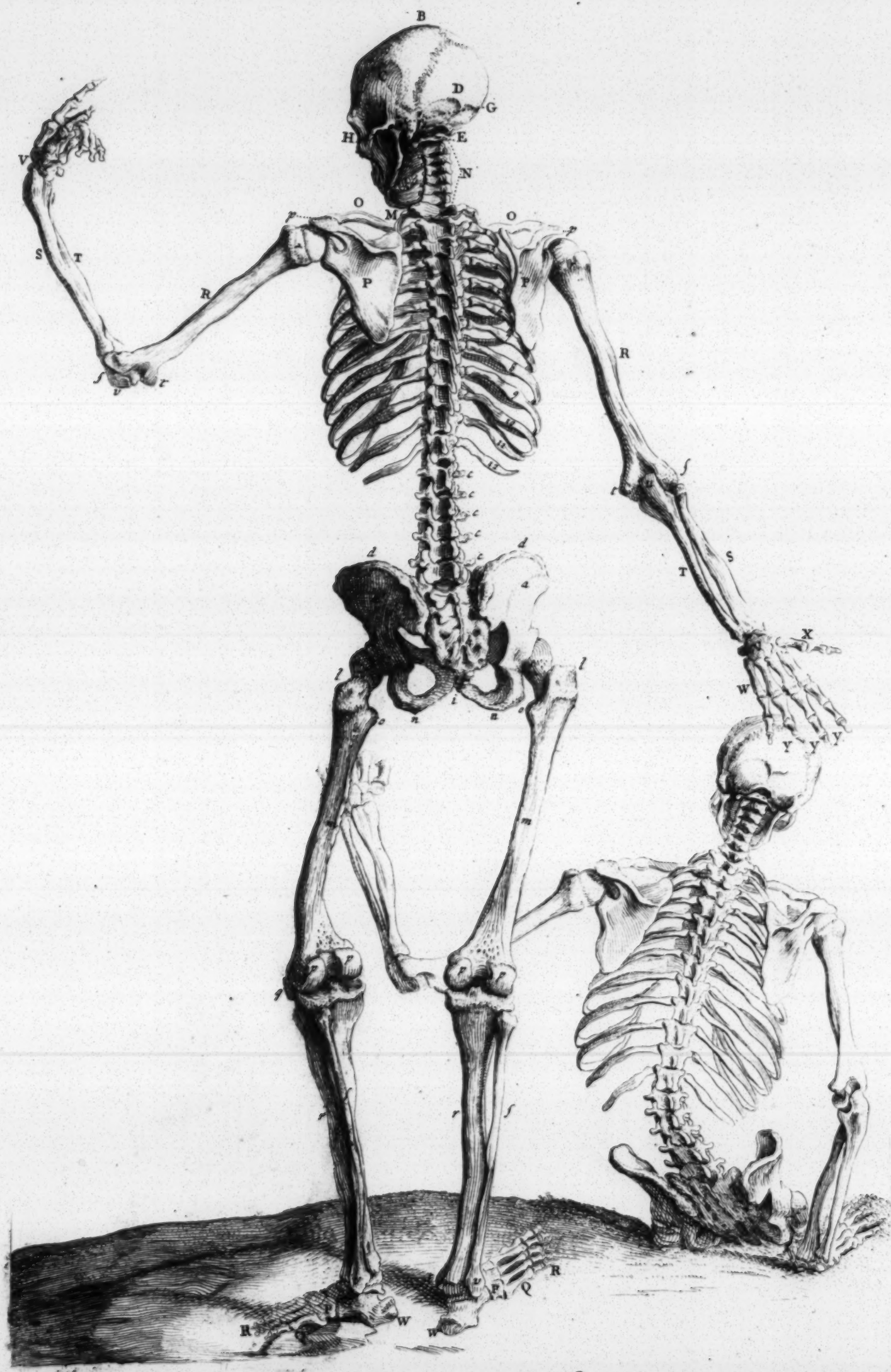


TAB.

TAB. IX.



TAB. X.



TAB. X.

The back View of the Skeleton of a Man.

- B *Offa Bregmatis.*
 C *Os Temporale.*
 D *Os Occipitis.*
 E The Mastoide Process.
 G The *Meatus Auditorius.*
 H *Os Jugale.*
 M The lower Jaw-bone.
 N The seven *Vertebrae* of the Neck.
 O The *Clavicula.*
 P The *Scapula.*
 p The *Acromium.*
 R The *Humerus.*
 r Its Head.
 i The inner Protuberance.
 f The outer.
 S The *Radius.*
 T The *Ulna.*
 u The *Olecranon.*
 V The Bones of the *Carpus.*
 W of the *Metacarpus.*
 X of the Thumb.
 Y of the Fingers.
 1, 2, 3, &c. The twelve Ribs.
 c, c, c, c. The *Vertebrae* of the Loins.
 h The *Os Sacrum.*
 i The *Os Coccygis.*
 a The Rise of the *Gluteus Minimus* from the *Os Ilium.*
 d Its Spine.
 n The obtuse Process of the *Ischium.*
 m The *Os Femoris.*
 l The great *Trochanter.*
 o The lesser.
 p, p The two Heads of its lower *Appendix.*
 q The *Patella.*
 r The *Tibia.*
 f The *Fibula.*
 i The inner,
 v The outer Ankle.
 W The *Os Calcis.*
 P The *Os Cuboides.*
 Q The Bones of the *Metatarsus.*
 R of the Toes.

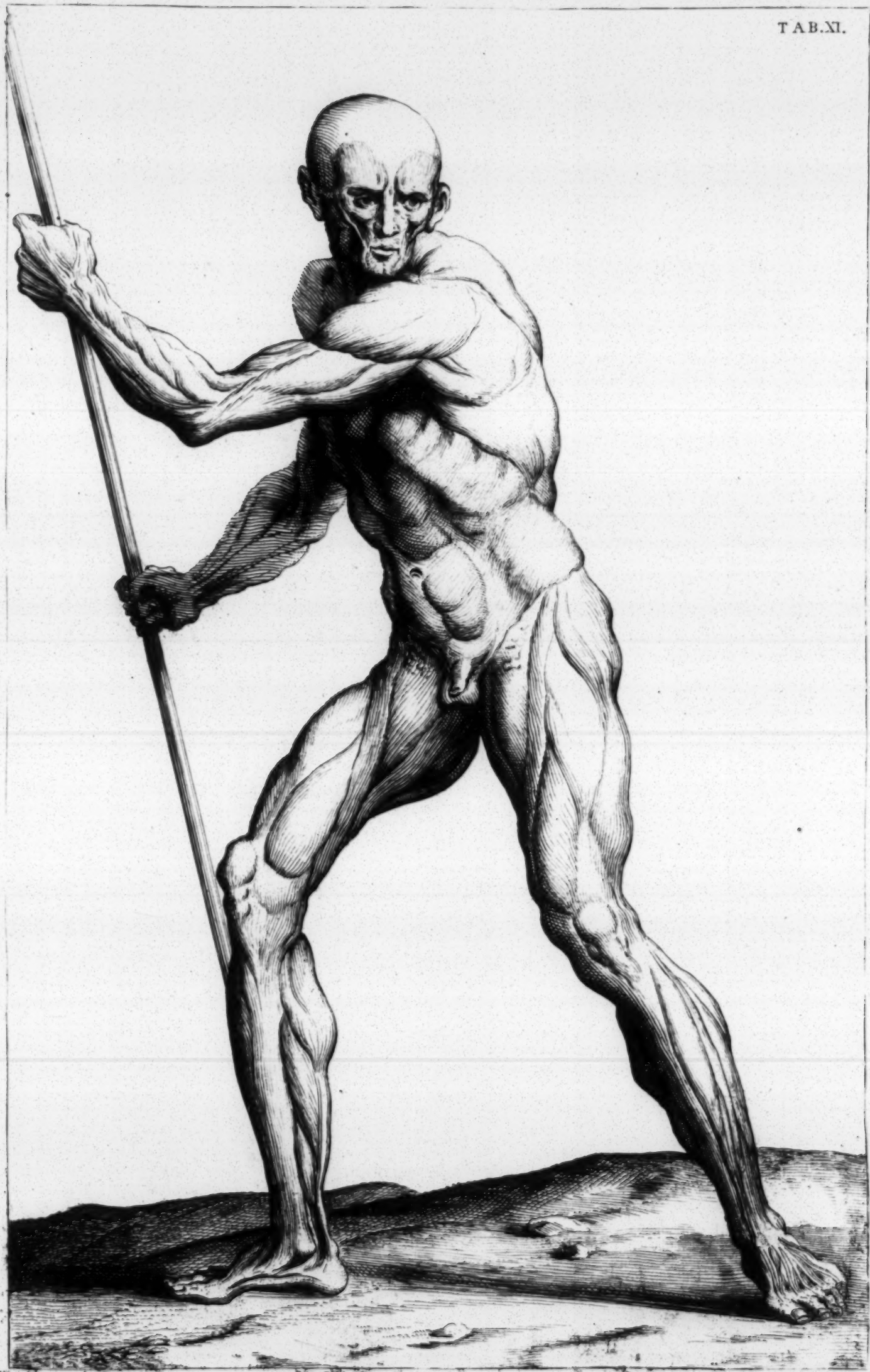
K k

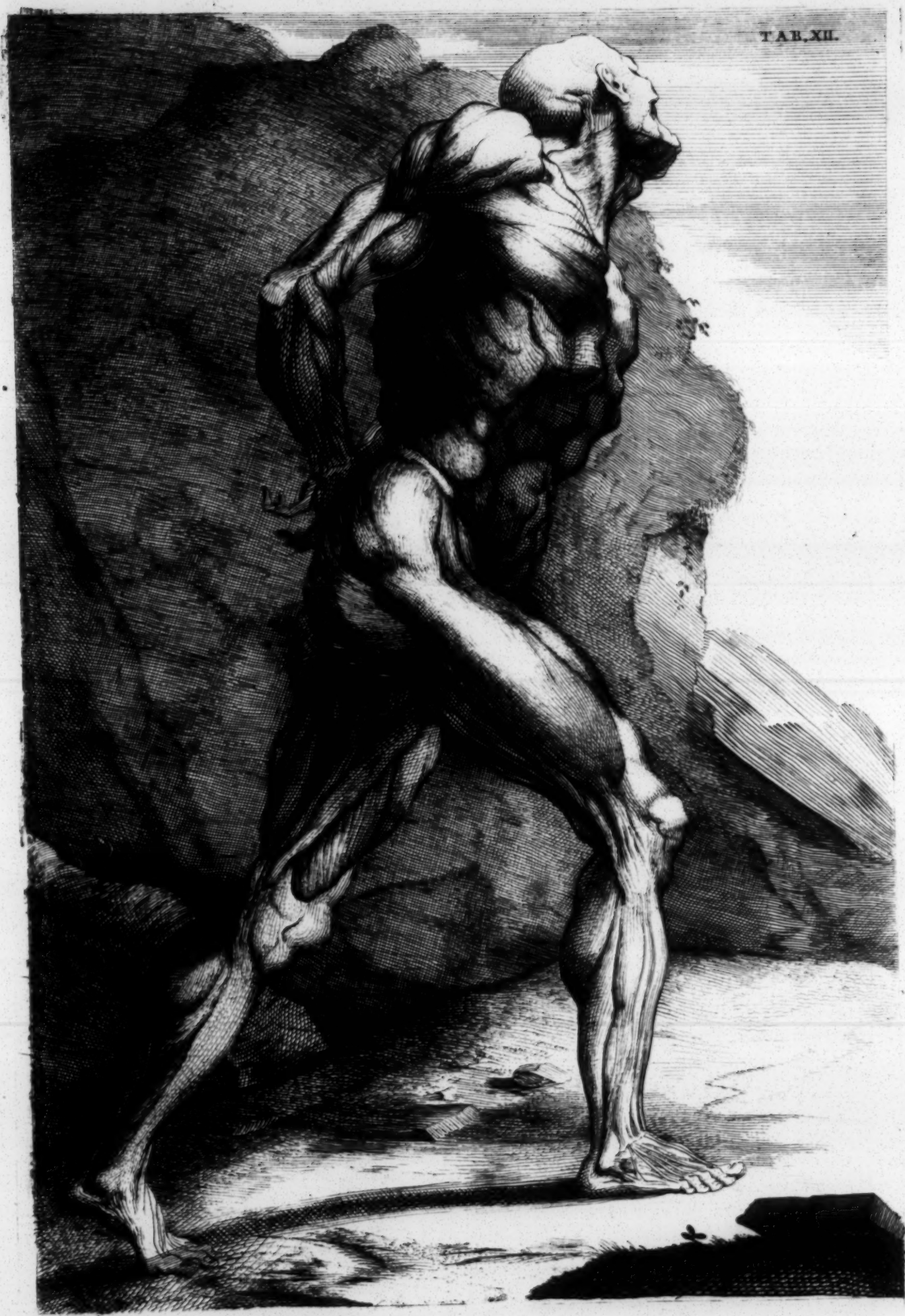
TAB.

TAB. XI. XII. XIII.

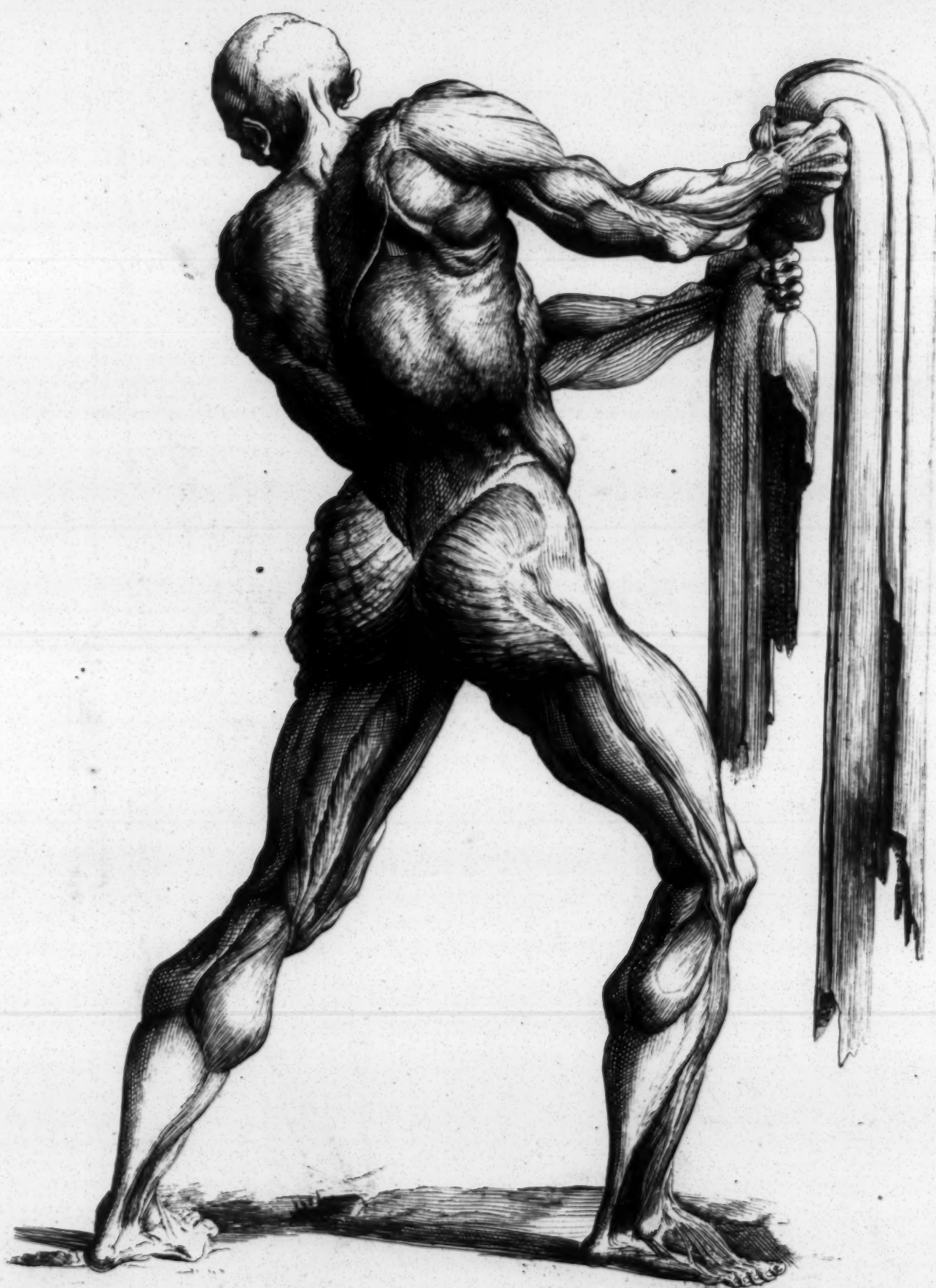
These Figures are chiefly design'd for the Use of Painters and Statuaries. The Outlines are copied from some of the greatest Masters, and the Muscles are laid in from the Life.

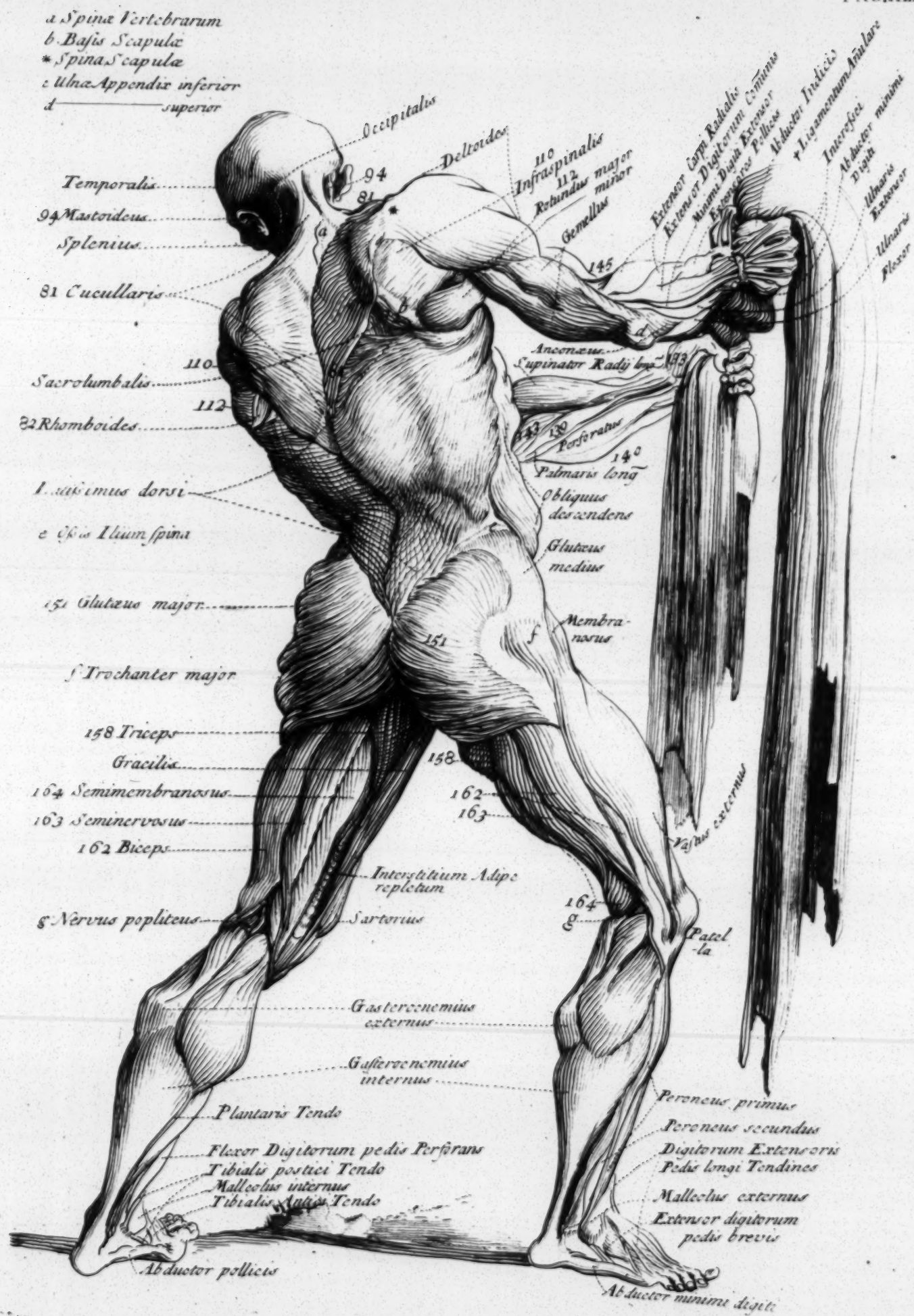




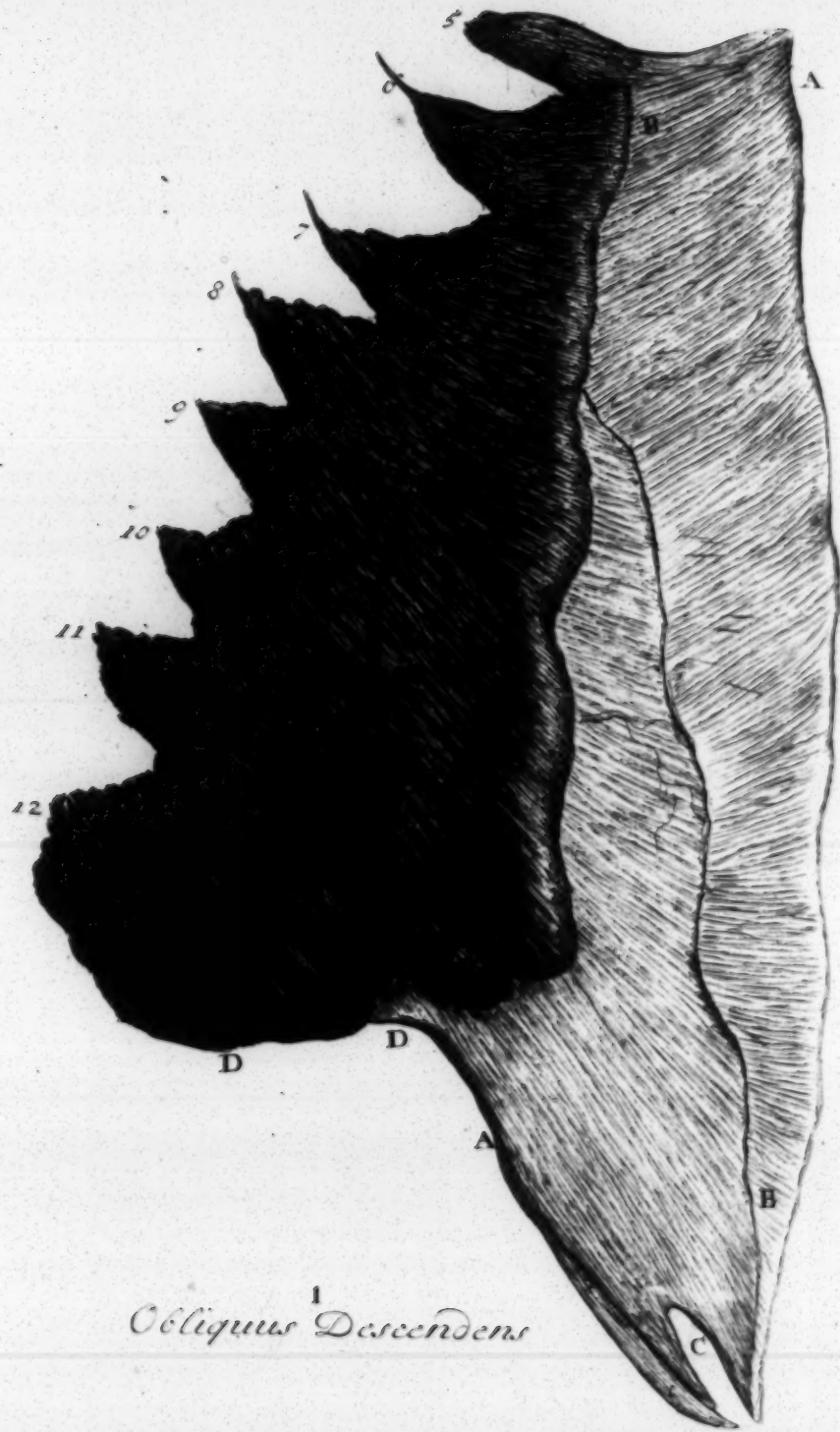


TAB. XIII.





TAB. XIV.



TAB. XIV.

1 *Shews the internal Surface of the Musculus Obliquus Descendens, when dissected and display'd.*

5, 6, 7, 8, 9, 10, 11, 12. Its Originations cut from the fifth, sixth, seventh, eighth, ninth, tenth, eleventh, and twelfth Rib: The superiour three or four Digitations being taken from between the like Endings of the *Serratus Major Anticus*.

AA Its broad membranous Tendon, which terminated in the *Linea Alba*, Spine of the *Os Ilium*, and fore part of the *Os Pubis*.

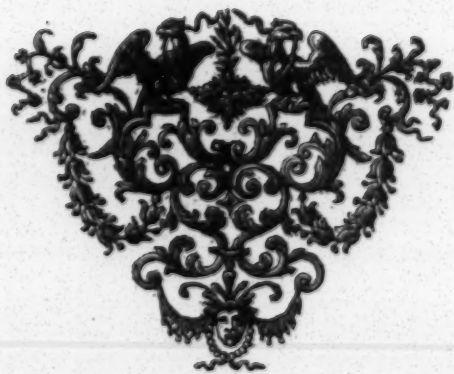
BB Part of the Tendon of the *Ascendens*, that cleaves inseparably to that of the *Descendens*.

C A Fissure, commonly call'd a Perforation, in the Tendon of the *Descendens*, in which the Spermatick Vessels pass to the *Scrotum*.

c The lower Margin of the Tendon of the *Descendens*, call'd by some the *Ligamentum Pubis*, cut from the Spine of the *Os Ilium* and *Os Pubis*, turn'd in towards the Cavity of the *Abdomen*, as here express'd. See Tab. xv. LL.

DD That part of this Muscle, which is fix'd to the Spine of the *Os Ilium*, and is employ'd in turning the Trunk of the Body to the contrary Side.

B The Blood Vessels of its lower Part.



TAB. XV.

- 2 The Musculus Obliquus Ascendens, with the Rectus and part of the Tendon of the Descendens, together with the Testis of the Left Side dissected and display'd; to shew not only the Progress and Union of the Tendons of the two oblique Muscles, over that of the Rectus, but the Artifice of Nature in transmitting the Spermatick Vessels from the Cavity of the Abdomen to the Testes, whereby the constant falling down of the small Guts into the Inguina and Scrotum is prevented.

AB The tendinous part of the *Ascendens*, that springs from the Spine of the *Os Ilium* backwards.

BB Its fleshy Part, which arises from the antierior Part of the Spine of the *Ilium*.

abc That part of the *Ascendens* that is fix'd to the lower Margin of the inferior Rib, and is employed in bringing the Trunk of the Body towards the back part of the *Os Ilium* of the same Side, in which Action it is assisted by the *Obliquus Descendens* on the contrary Side, as before noted.

CD A part of the *Ascendens*, that lies between the eleventh and twelfth Ribs.

DD The Tendon of the *Ascendens* passing over the *Rectus*, where it was fairly separated, as here express'd, from that of the *Descendens*.

EE Part of the Tendon of the *Descendens* turn'd up, after the fleshy part of that Muscle was cut off, to shew where it adheres inseparably to the subjacent Tendon of the *Ascendens*, as they both march together over the *Rectus* GG, to the *Linea Alba*.

F Part of the *Transversalis*.

H The Navel.

IKL A Portion of the Tendon of the *Obliquus Descendens*.

I That part of it which adher'd to the fore part of the Spine of the *Os Ilium*.

ddff Those Parts of this Tendon which were here divided from each other.

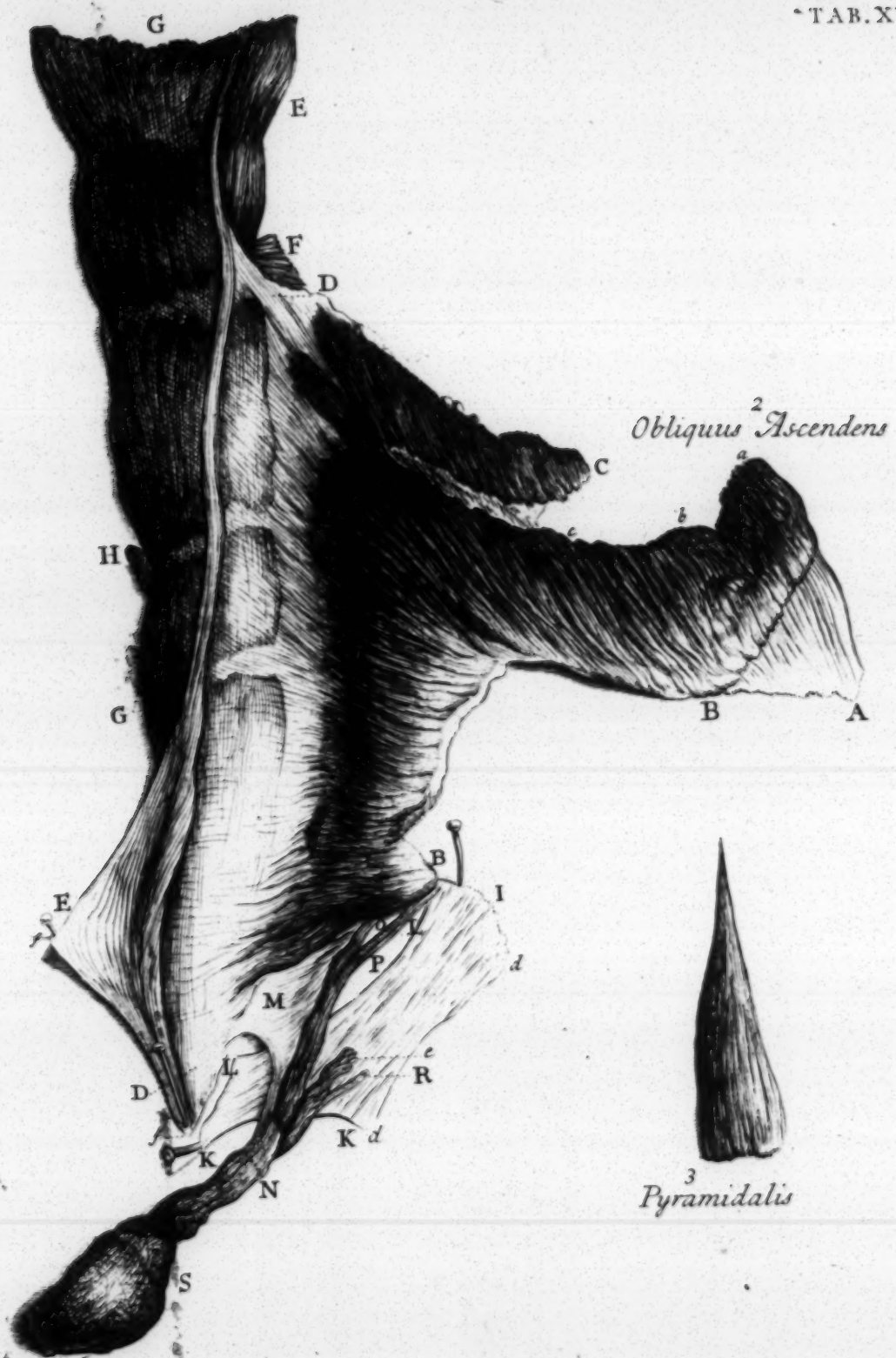
KK That part of it which makes the *Annulus*, or Fissure, by which the Spermatick Vessels pass to the *Testes*.

LL Its internal Margin, commonly call'd the Ligament of the *Pubes*, which, being as it were turn'd in towards the Cavity of the *Abdomen*, does by that means prevent any Ruptures or Extrusions of the Guts in that part, that is between the *Os Pubis* and Spine of the *Os Ilium*, and upper part of the Thigh.

MN Part of the *Peritoneum*, which descends with the Spermatick Vessels into the *Scrotum*, and makes what is call'd the *Tunica Vaginalis*.

OP The *Musculus Cremaster*, which in this Subject was double at its Origine.

e The

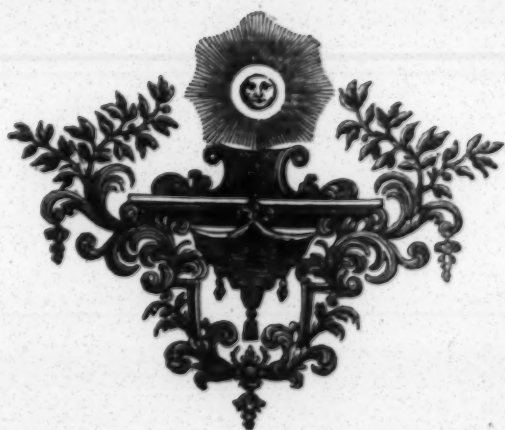


e The *Vasa Præparantia*.

R The *Vas Deferens* cut off.

S The Testicle, as it appear'd in the *Tunica Vaginalis*.

It appears by this Figure how the Spermatick Vessels pass between the two oblique Muscles in their way to the *Testes*. For the Perforations in these two oblique Muscles, not corresponding to each other, necessarily prevent the Intestines from passing the same way with the Spermatick Vessels; which, had the Orifices in these Muscles been opposite to each other, must have happened, as we see it does, when that Distemper, which we call a Rupture, attends these Parts; in which case it is very obvious, that the *Annulus*, or Perforation of the *Descendens*, here express'd at K K, being enlarg'd or split up according to the length of the Fibres of the Tendon, becomes opposite to that of the *Ascendens* at O. Hence the small Guts necessarily pass into the *Scrotum* in an erect Posture, unless prevented by a Compress, or Truss, artificially made and applied to the Part; and we are assur'd from Experience, that, when this Remedy is us'd in young Persons, or where the Malady is recent, it's often cur'd.



TAB. XVI.

4 *The internal Surface of the Rectus Abdominis of the Left Side.*

AB Tho' on the inside there appear'd but one tendinous Interfection at A, and half an one at B, in this Subject, yet the external Surface of this Muscle had three compleat tendinous Interfections. The Number and Situation of these Interfections vary in different Subjects, and in some this Muscle has been found without any.

CD The Epigastrick, C, and Mammary Veins and Arteries, D, (as they are call'd) but are no more than the common Blood Vessels of this Muscle, and the subjacent Parts.

E The Tendon of the lower end of this Muscle, which is implanted on the *Os Pubis*.

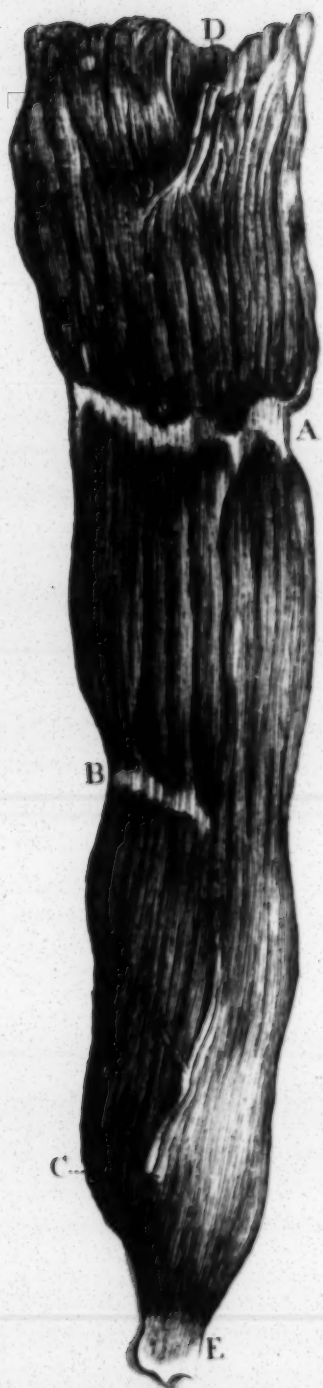
5 *The internal Surface of the Transversalis Abdominis of the Left Side.*

ABCDD Its tendinous Origine, that springs from the *Vertebra* of the Loins, A. Its fleshy Beginning from the Spine of the *Os Ilium*, B. That part of it which adher'd to the lower Margin of the Tendon of the *Descendens*, commonly call'd the *Ligamentum Pubis*, is express'd at C, and that freed from the cartilaginous Endings of the Ribs at DD.

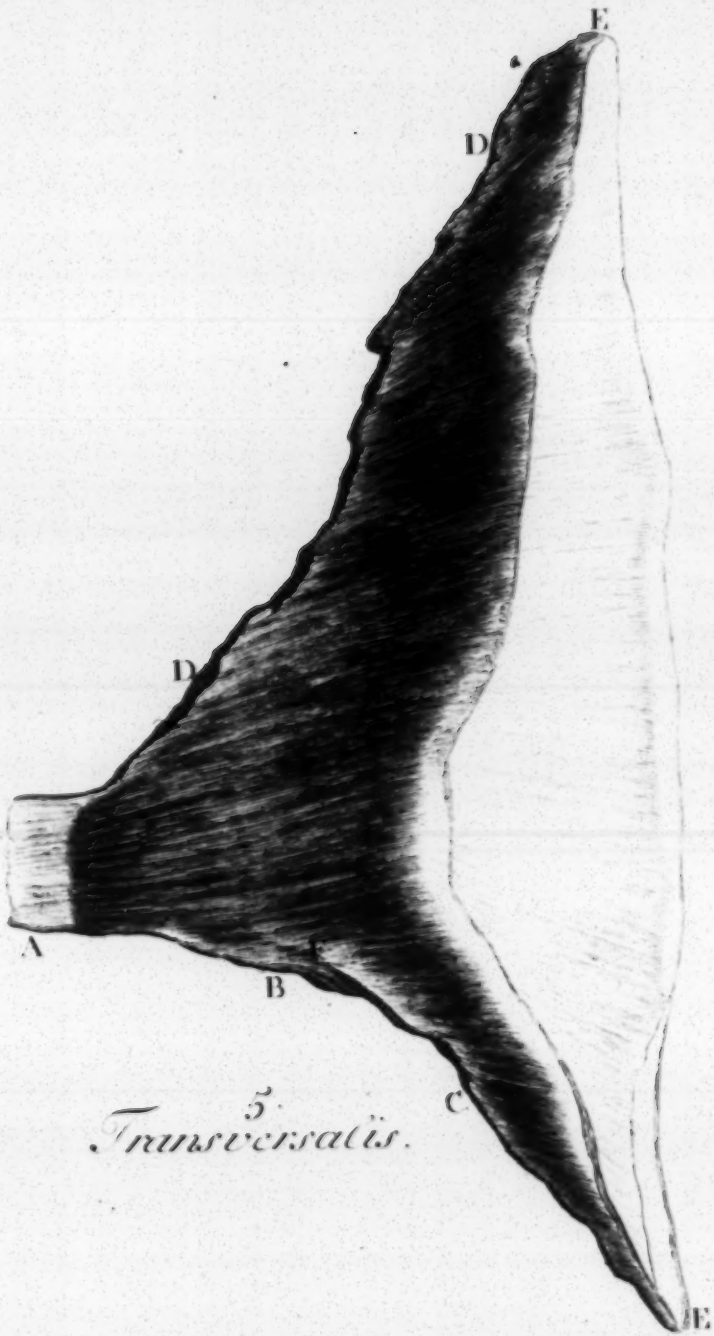
EE Its broad membranous Tendon, which adheres to the *Peritonæum*, as indeed does the whole Muscle, except that part of it between ABD.

F Shews where the Spermatick Vessels pass it.

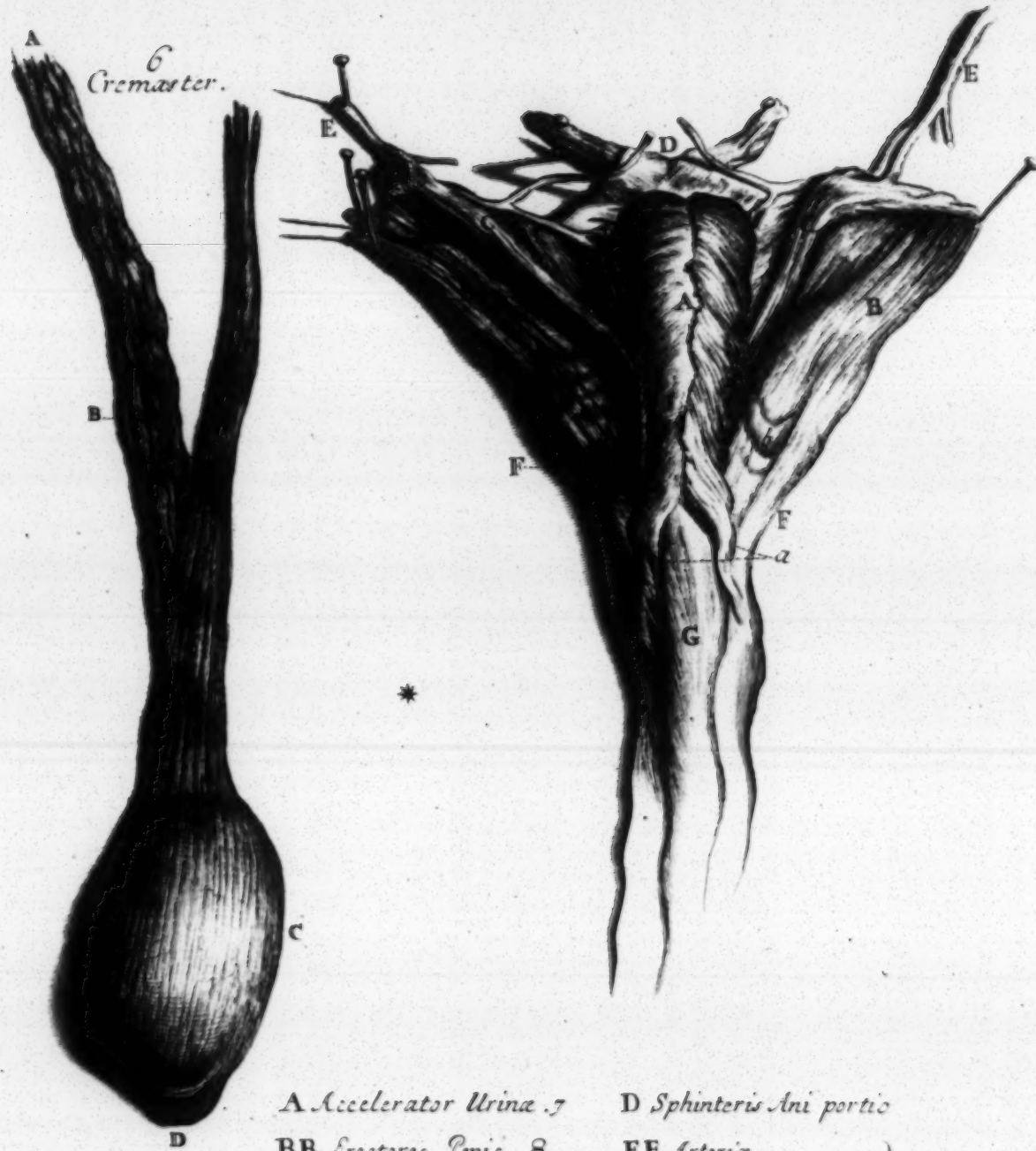




4.
Rectus.



5.
Transversalis.



- | | |
|----------------------------|--------------------------------|
| A Accelerator Urinae .7 | D Sphinteris Ani portio |
| BB Erectores Penis .8. | EE Arteria |
| CC Transversales Penis .9. | FF Corpora Cavernosa |
| | G Corpus Cavernosum Vaghenae . |

TAB. XVII.

6 The *Cremaster* Muscle, as I have found it expanded at its Termination on the *Tunica Vaginalis*, inclosing the *Testis* in a robust Subject.

A The *Corpus Varicosum* of the *Vasa Preparatoria*.

B Part of the *Vas Deferens*, inclosed in the same Membrane with the *Vasa Preparatoria*.

C The Testicle inclosed in the *Tunica Vaginalis*.

D The *Epididymis*, as it appears under the *Tunica Vaginalis*.

7 A The external Surface of the *Accelerator Urinæ* inclosing the Bulb of the *Corpus Cavernosum Urethræ*.

a Its two Productions inserted into the Sides of the *Corpora Cavernosa Penis*.

8 BB The *Erectores Penis*, cut off from their fleshy Originations at the *Ischion*, and left at their Insertions, at the beginning of the *Corpora Cavernosa Penis*, bb.

9 CC The *Transversales Penis*, as they appear'd in this Subject.

D Part of the *Sphincter Ani*.

EE The Arteries that convey Blood to the *Corpora Cavernosa Penis*, FF, and to the *Corpus Cavernosum Urethræ*, G.



TAB. XVIII.

10. 10 The *Erectores Clitoridis* freed from their Originations, and left at their Insertions into the Beginnings of the cavernous Bodies of the *Clitoris*.

11 Part of the *Sphincter Vaginae* freed from the *Vagina*, and left at its membranous Connexion to the *Clitoris*.

AA The *Crura* of the *Clitoris*.

aa Those parts of its cavernous Bodies that were cut from the *Ossa Pubis*.

B The Body of the *Clitoris*, with its Nerves and Blood Vessels.

C Part of the *Nymphae*.

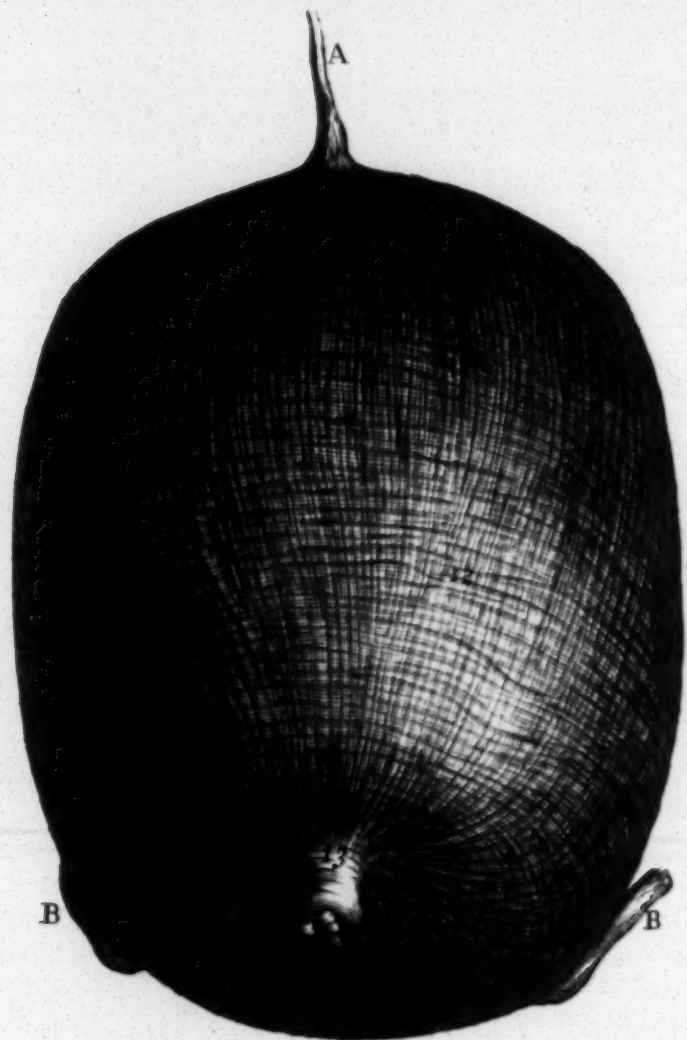
12 The *Detrusor Urinae*, as it appears in a Bladder I have now by me; but in other Subjects you must not expect to find these Fibres so conspicuous as here represented.

13 *Sphincter Vesicae*.

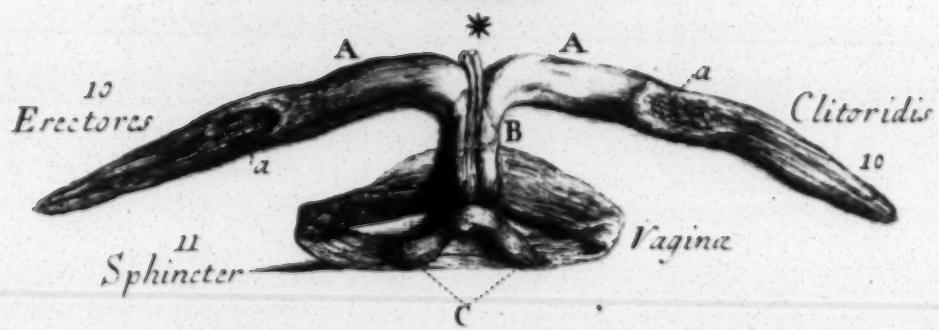
A The *Urachus*.

BB Part of the Ureters, near their Insertions into the Bladder.

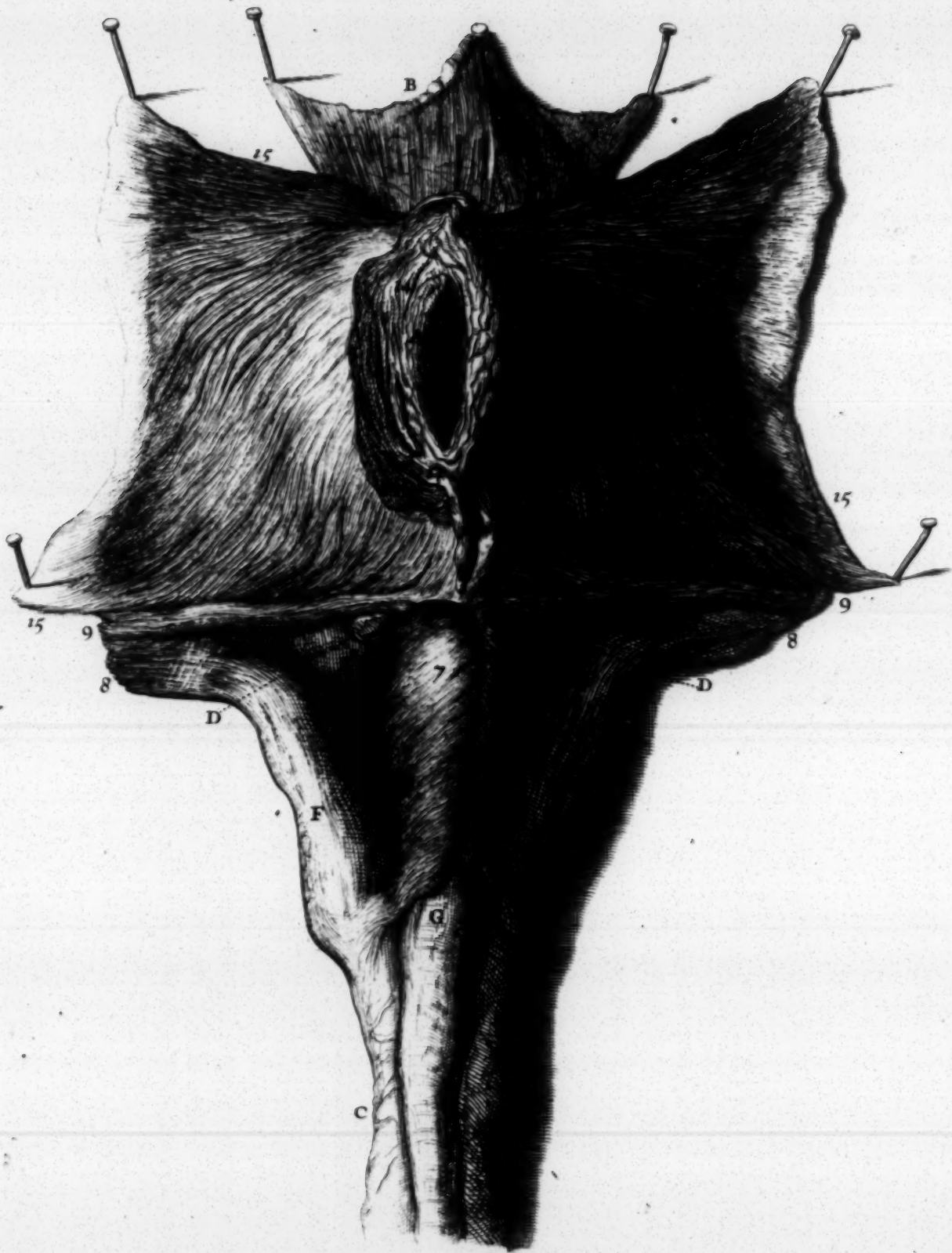




¹²
Detrusor Vrinae
¹³
Sphincter Vesicae



TAB. XIX.



TAB. XIX.

- A The *Anus*.
 14 The *Sphincter Ani*.
 B Part of the *Rectum* pinn'd out.
 15 The *Levator Ani* freed from its Origination, and left at its Insertion, pinn'd out.
 C The *Corpora Cavernosa Penis*.
 DD The *Glandulae Mucosae*.
 7 EE *Acceleratores Urinae*.
 88 The Origination of the *Erectores* cut from the *Ossa Ischia*.
 FF Their Insertion.
 G *Corpus Cavernosum Urethrae*.
 99 *Transversales Penis*.



TAB. XX.

AA The *Sphincter Ani* encompassing the *Anus*.

aa The internal Membrane of the *Anus*.

BB The *Levator Ani* freed from its Origination, and left at its Insertion, here pinn'd out.

CC The *Membrana Adiposa*, (which is continued from the *Peritoneum*) freed from the *Rectum*, and display'd.

D The Body of the *Rectum*, with Muscular Fibres passing according to its Length.

EE The circular Fibres, lying under the Longitudinal, which are here rais'd and turn'd off.

F The internal Membrane of the *Rectum* pinn'd out. This internal Membrane, being much larger than the Muscular Inclosure, is seen full of Folds, on dividing the Gut according to its Length; sometimes 'tis so much relax'd, as to slip out at the *Anus*, which Case is called *Procidencia Ani*.

16 The *Occipitalis*.

17 The internal Surface of the *Frontalis*, of the Left Side.

A The two tendinous Parts, which are continued to each other, on the upper part of the *Cranium*.

a That part of the Frontal Muscle which arises from the lower part of the Bone of the Nose.

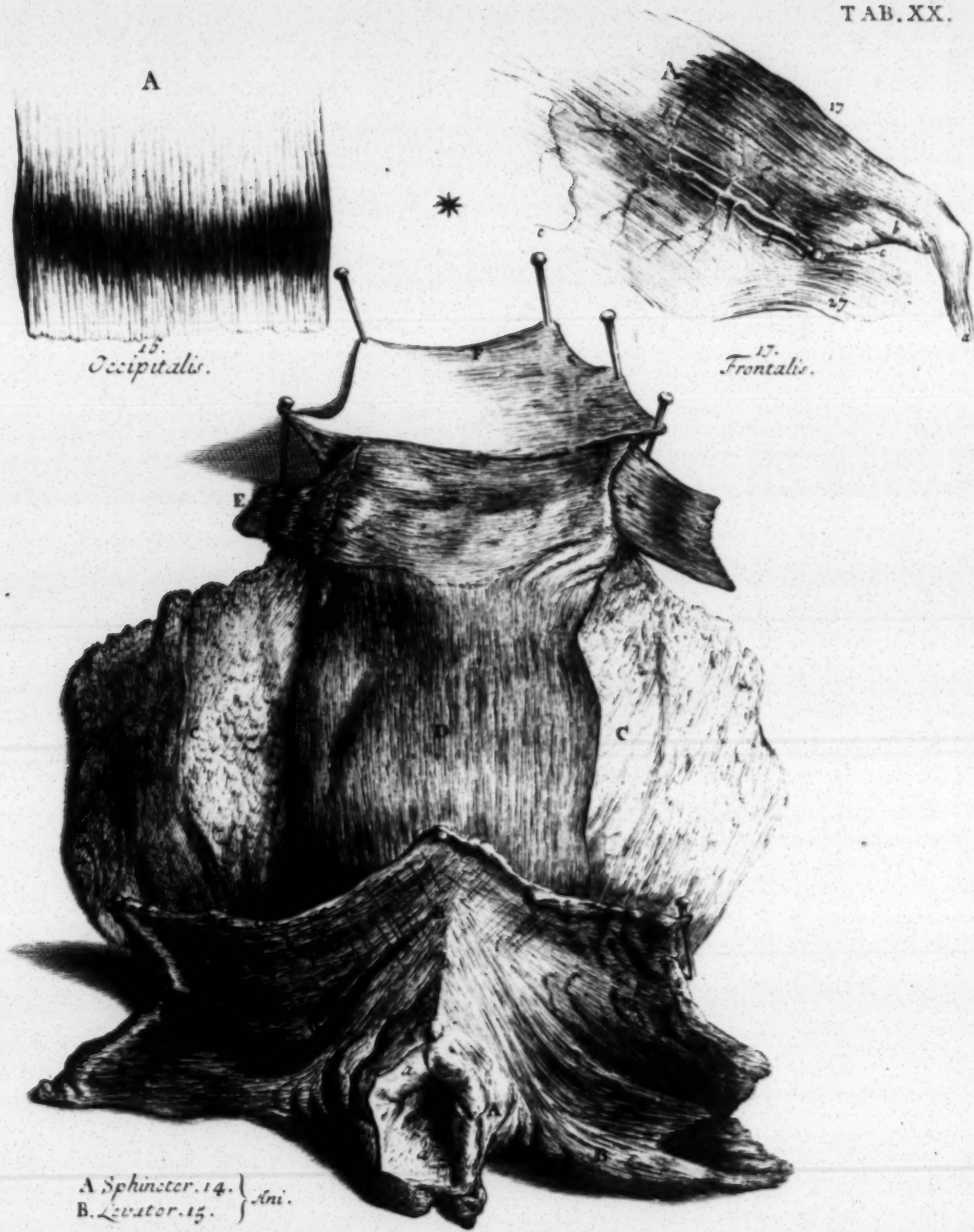
b That part of the Frontal Muscle call'd *Corrugator*.

cc A Branch of an Artery that passes a Perforation in the Scull, a little above the Orbit, and distributes its Capillary Branches, as here express'd, on the internal Surface of this Muscle.

d Two Branches of the Nerve, which accompanies the Artery.

27 Part of the *Musculus Orbicularis Palpebrarum*.







18. Quadratus Genæ, seu Quad. Colli.
 19. Buccinator Quadrato Genæ lectus.
 20. Zygomaticus.
 21. Elevator Labiorum.

22. Depressor Labiorum.
 23. Orbicularis Labiorum.
 24. Elevator labii superioris proprius.
 25. Depressor labii inferioris proprius.

TAB. XXI.

Since cutting off the Muscles of the Face, and then displaying them, (as I have done those of most other Parts) would produce a Figure of them by no means instructive; I shall therefore represent them in the two following Tables in situ, in which these Muscles are express'd much larger than those in the whole Figures.

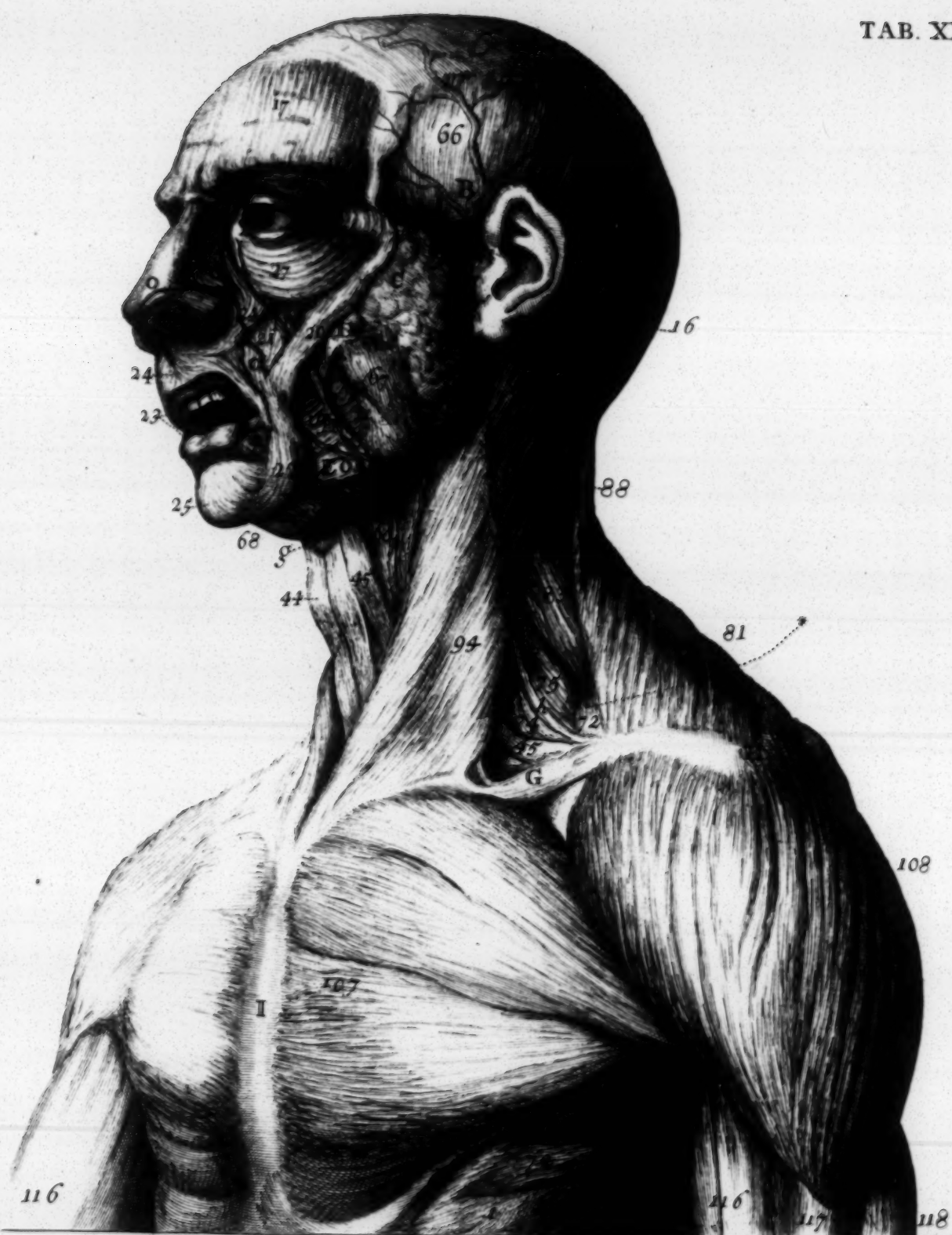
- 18 18 The *Quadratus Genæ*, as much as can be seen in one View.
- 19 That part of it that is over the *Buccinator*.
- 20 The *Zygomaticus*, the lower part of which lies under part of the *Quadratus*.
- 21 Another part of the *Quadratus*, on the *Elevator Labiorum*.
- 22 The *Depressor Labiorum*.
- 23 The *Orbicularis Labiorum*.
- 24 The *Elevator Labii Superioris*.
- 25 The *Depressor Labii Inferioris*.
- A The *Musculus Frontalis*.
- B The *Orbicularis Palpebrarum*.
- C The *Temporalis*.
- D The *Elevator Auriculæ*.
- E The *Occipitalis*.
- F The *Os Jugale*.
- G, g The *Elevator Alæ Nasi*.
- H The Parotide Gland.
- I The *Ductus Salivaris* under the *Quadratus*.
- K Part of the *Splenius*.
- L The *Deltoides*.
- M Part of the *Gemellus*.
- N Part of the *Brachæus Internus*.
- O *Biceps Cubiti*.
- P Part of the *Serratus Major Anticus*.
- Q Part of the *Obliquus Descendens*.
- k The Extremity of the *Clavicula*, next
- l The *Acromium Scapulæ*.

The rest of the Parts that appear under the *Quadratus* on the Neck and Breast, may be known by the following Figure.

TAB. XXII.

- 19 The *Buccinator*.
 20 The *Zygomaticus*.
 21 The *Elevator Labiorum*.
 22 The *Depressor Labiorum*.
 23 The *Orbicularis Labiorum*.
 24. 24 The *Elevator Labii Superioris Proprius*.
 25 The *Depressor Labii Inferioris Proprius*.
 A Part of the *Os Jugale*.
 B The Temporal Artery.
 CC The Parotide Salival Gland.
 D Its *Ductus Salivalis* passing on the *Musculus Masseter*, and through the *Buccinator*, into the Mouth.
 E Part of the lower Jaw-Bone bared.
 o, o, o, o, A Branch of the Carotide Artery, which constantly passes this way to the Muscles of the Lips and Parts adjacent.
 N A Branch of the external Jugular Vein.
 f An Appearance of the same Vein, before it passes the Body of the inferior Maxillary Gland.
 g The Maxillary Salival Gland.
 G The *Clavicula* bared.
 H The *Acromium Scapulae*, where it is joyn'd to the *Clavicula*.
 h A Trunk of the Nerves, that compose the Axillary Nerve.
 I The *Os Pectoris*, or *Sternum*.
 i Some Remains of the external Jugular Vein on the Mastoide Muscle.
 * 72 Part of the *Serratus Major Anticus*, which appears, as here express'd, above the *Clavicula*, in an Interstice made by the *Scalenus* forwards, the *Levator Scapulae* above, and the *Cucullaris*.
 N. B. The rest of the Figures, or Numbers, may be explain'd by the general Index of the Muscles.





- | | |
|-------------------------|---|
| 19. Buccinator. | 23. Orbicularis Labiorum. |
| 20. Zygomaticus. | 24. 24. Elevator Labij Superioris proprius. |
| 21. Elevator Labiorum. | 25. Depressor Labij inferioris proprius. |
| 22. Depressor Labiorum. | |



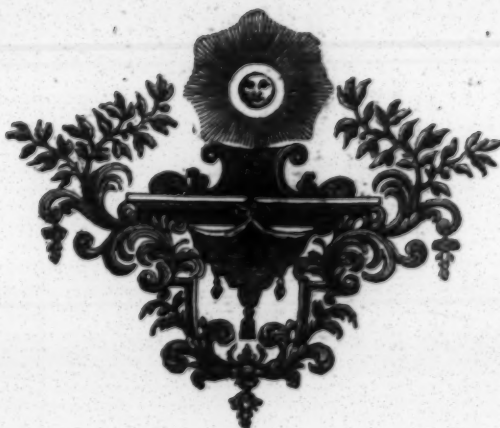
- | | |
|---|--|
| A Os Jugale | † Ramulus Quinti Nervorum Parie ad Dentes |
| BBB Maxilla Inferior denudata | Maxilla Inferioris portione |
| C Processus Mastoideus | H. Musculi Styloglossi pars |
| D Processus Styloides | II Vena Jugularis interna } utraq. Cera plena |
| E Musculus Parvus, qui in nonnullis Cadaveribus | KK Arteria carotis |
| Ligamentum eodem modo est, ab Apice Processus | LL Processus Transversi Vertebrae Colli |
| Styloidis ad Maxillam Inferiorem pertingens | II Nervi Intercostales et Parie 1 ^o gi Trunci |
| F Arteria Ramulus Cera repletus | M Os Hyoides |
| G Ductus Salivaris Glandulae Maxillaris | N Cartilago Scutiformis |
| Inferioris Abscessus quo loci sub Musculo | O Glandula Thyroides |
| Mylohyoideo transit. | |

TAB. XXIII.

The Parts here represented, being sufficiently described in the References at the bottom of the Plate, need no other Explication, except

101 101 The lowermost of which denotes one of the *Intertransversales*, which were discover'd by the Author, after his *Syllabus* and most of the Plates were finish'd, for which reason those Muscles could not be insert'd under a distinct Number. *Vid.* Tab. XLIV. The uppermost shews the thicker and shorter Production of the *Transversalis*, which is insert'd near the Mastoide Process. But the slenderer and longer Production of this Muscle is insert'd beside

102 Part of the *Longissimus Dorsi*, by others call'd *Par tertium Fallopii*. *Vid.* Tab. XLV.

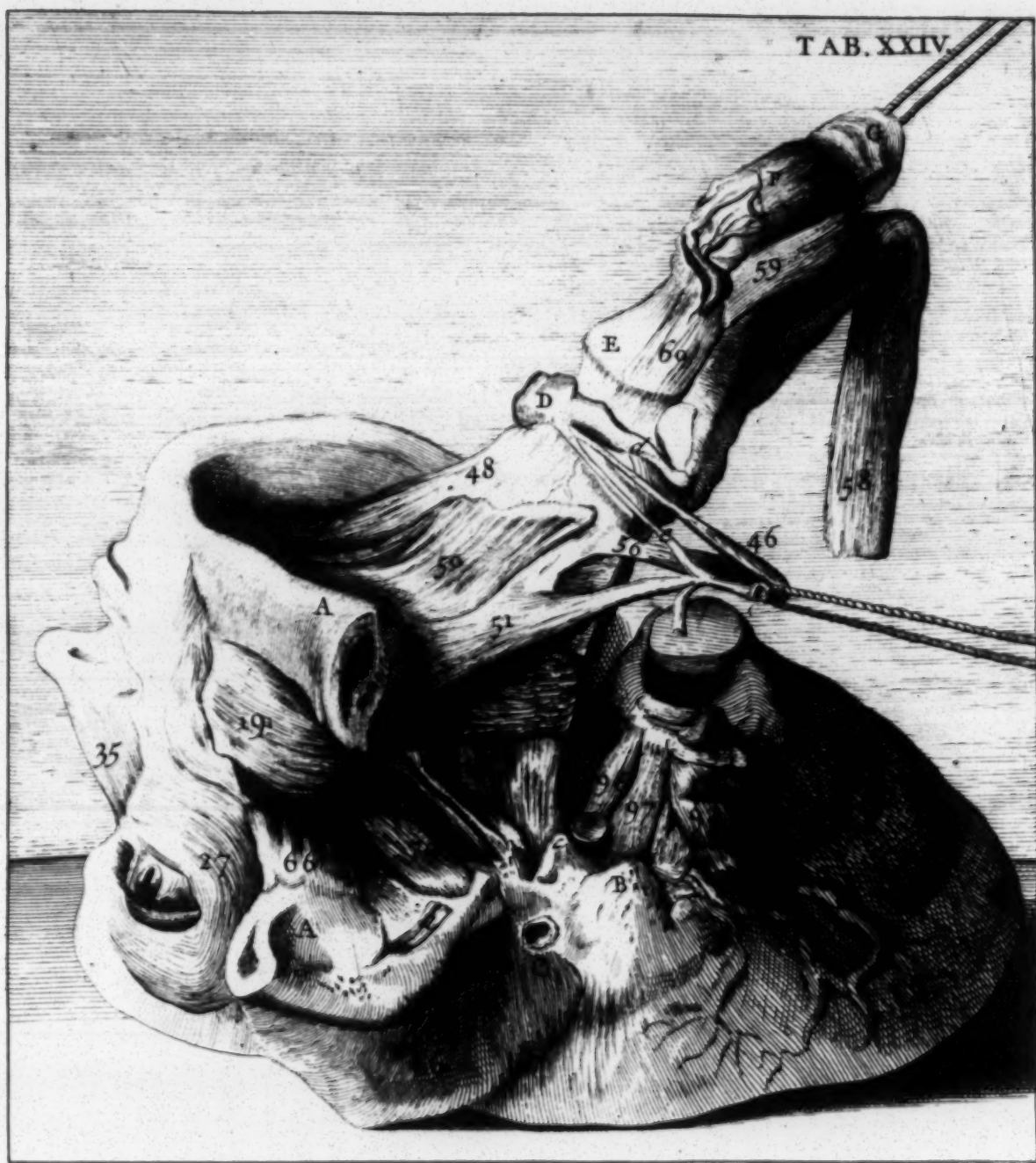


TAB. XXIV.

This Table likewise needs no other Explication, than what is engraven on the bottom of the Plate, except

- a* The Nerve and Blood Vessels passing into the lower Jaw.
- e* The Ligament connecting the cartilaginous *Appendix* of the *Os Hyoides* to the Styloidal Process.





AA. Maxilla inferior divisa.

B. Processus Mammillaris.

C. Arteria Carotis.

C. Meatus Auditorius.

cc. Processus Styloides divinus.

D. Os Hyoides.

d. Cornu dextrum ejusdem.

E. Cartilago Thyroides.

F. Glandula Thyroides.

G. Asperæ Arteriæ portio.

TAB. XXV.

*The Muscles of the Eye-lid and Eye, the Ala Nafi & Auricula,
as big as the Life.*

FIG. I.

The Muscles of the Palpebra, and right Eye it self, dissected and display'd.

- a* The inner *Canthus*.
- 27 27 The *Orbicularis Palpebræ*.
- 28 The *Aperiens Palpebram Rectus*.
- 29 The *Obliquus Superior*, with
d Its *Trochlea*.
- 30 The *Obliquus Inferior*.
- 31 The *Elevator*.
- 32 The *Depressor*.
- 33 The *Adductor*.
- 34 The *Abductor Oculi*.

FIG. II.

The back part of the Muscles of the Left Eye dissected and display'd.

N. B. The Names of each Muscle being graved on the Copper-Plate, I shall only add here.

- d* The *Trochlea*.
- a* Part of the Optick Nerve cut off.
- e* The Terminations of the two Tendons of the oblique Muscles on the *Scleroticis*.

FIG. III. IV.

The Muscles of the Eye dissected, and so dispos'd, as to shew the natural Position of each Muscle in the Left Eye.

N. B. The Muscles are explain'd by the preceding Figure, or the general *Index*.

- aa* The Optick Nerve.
- b* A Portion of the external Margin of the upper part of the Bone of the Orbit, to which the *Trochlea* is fix'd.
- c* Part of the external Margin of the lower part of the Bone of the Orbit, whence the *Obliquus Inferior* arises.
- d* The Tendon of the *Obliquus Superior* passing through the *Trochlea*, the other part of its Tendon is here express'd, marching under that of the *Elevator* to its Termination on the *Scleroticis*, near the Insertion of the *Obliquus Inferior*, as express'd in Fig. II. and III. at *e*.

FIG.

FIG. V. VI.

- 35 The Elevator Alæ Nasi.
 36 The Dilator Alæ Nasi & Elevator Labii Superioris.
 37 The Constrictor Alæ Nasi.

N. B. In Fig. v. is express'd

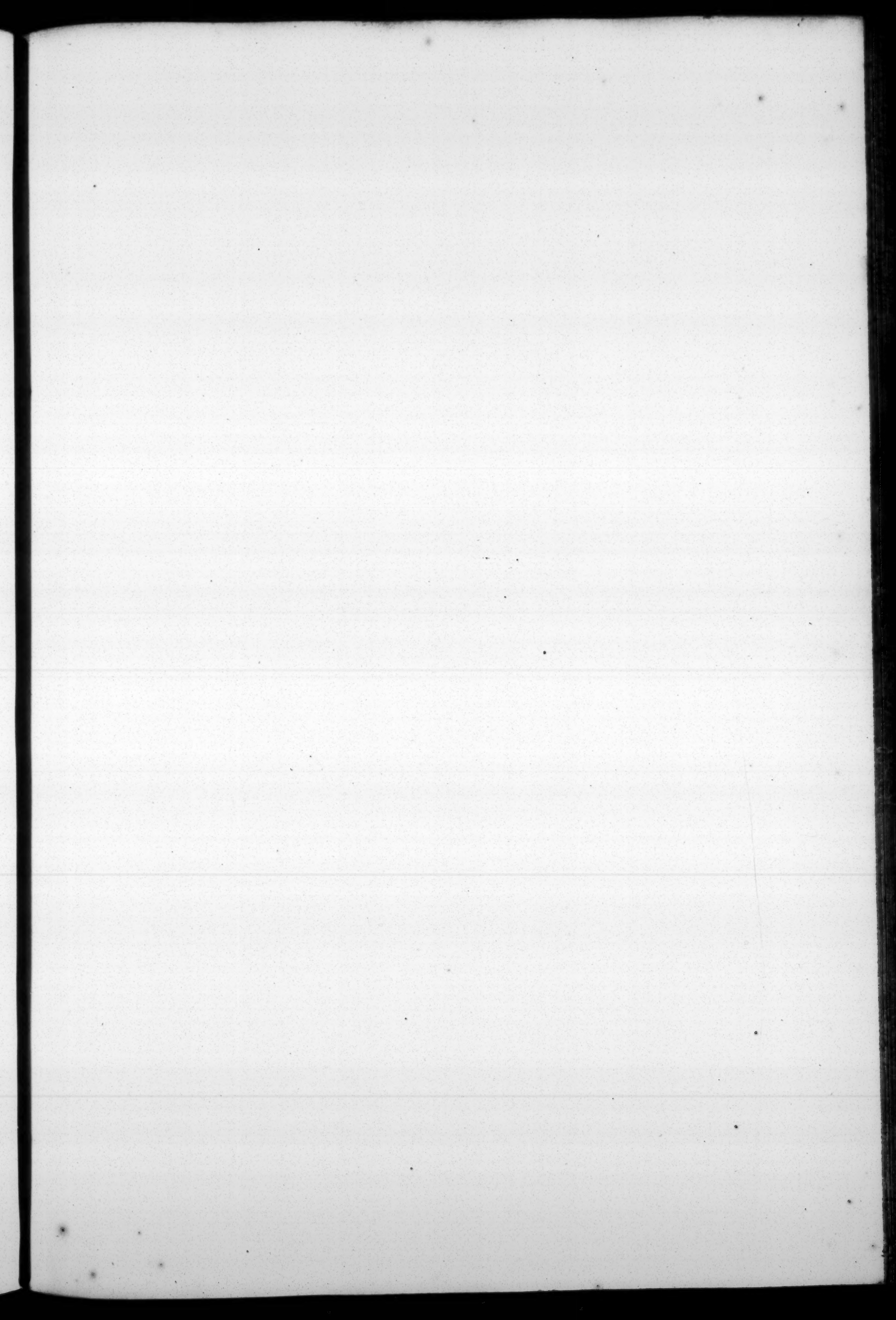
- 17 Part of the Frontalis.
 27 The Orbicularis, part of that of the Left Side at the great Angle being raised, to shew
b The internal and fleshy Production of the *Musculus Frontalis*.
a The external Production of the Frontal Muscle, springing from the Bones of the Nose, which is very visible in some Persons when in Passion.

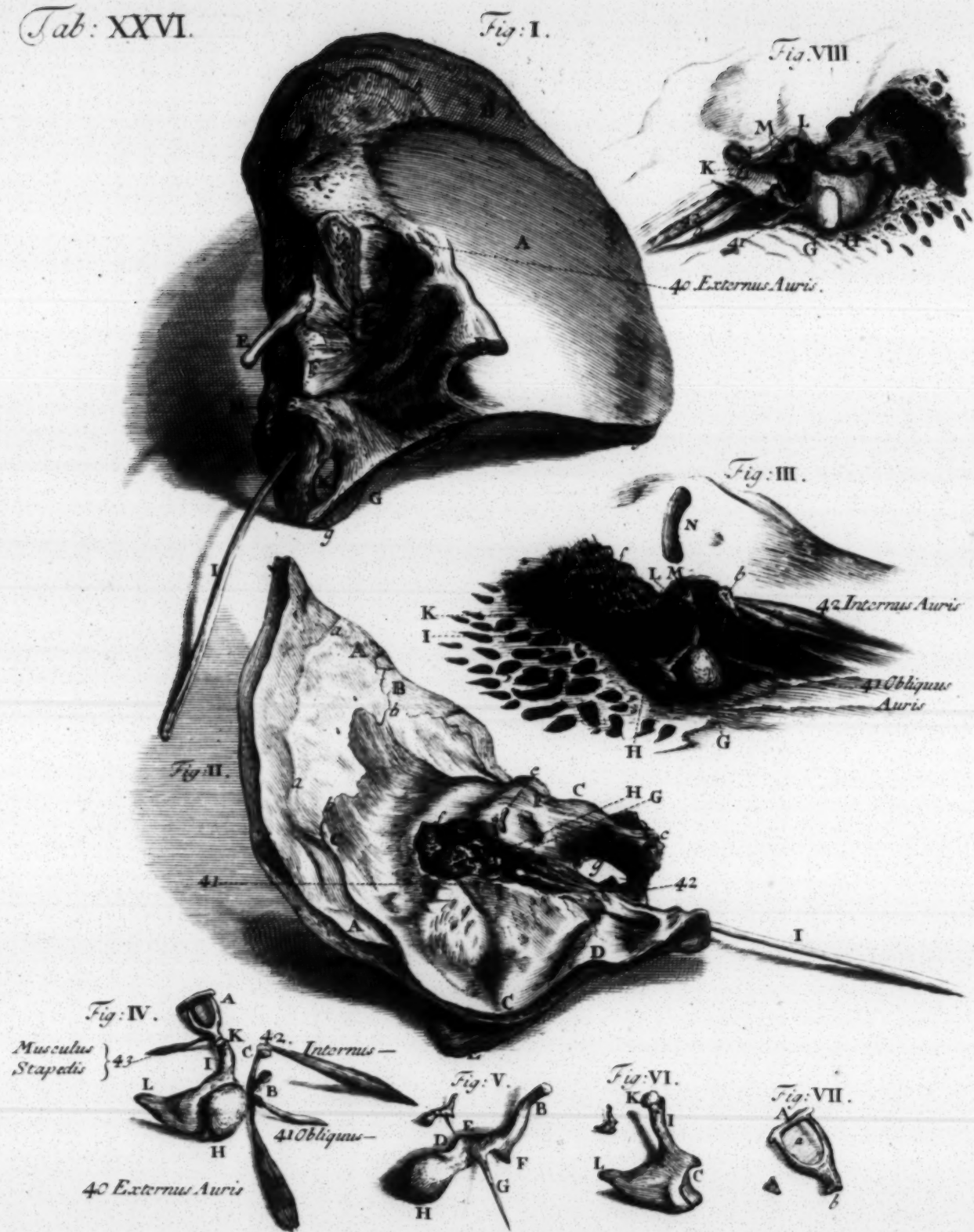
FIG. VII.

The Left Ear, with its Muscles, as I have most commonly found them, they varying in their Figure in different Subjects.

- 38 Attollens Auriculam.
 39 Retrahens Auriculam.
 A A That part of the Ear called *Helix*.
 B *Anthelix*.
 C *Tragus*.
 D *Antitragus*.
 E *Lobus Auris*.







TAB. XXVI.

FIG. I.

Part of the Right Os Temporale, &c. containing the Organs of Hearing of the Right Side, as big as the Life.

- A The external convex Surface.
- B Part of the *Os Sincipitis*.
- C The *Processus Mastoideus*.
- D Part of the *Os Jugale* cut off.
- E The *Processus Styloides*.
- F Part of the *Os Temporum*, behind which the Carotide Artery passes to the Brain.
- G Part of the *Os Sphenoides*.
- H An acute Process of the last mention'd Bone, at the Root of which the Muscles of the *Uvula* spring.
- I A Probe inserted into a Perforation, between the *Os Sphenoides* and *Os Temporum*, by which the *Ductus à Palato* passes into the *Tympanum*, as express'd Fig. II.
- K The sixth *Foramen* of the *Os Sphenoides*, near the Root of the *Processus Pterygoides*, by which the fifth pair of Nerves pass.
- a The upper part of the Passage from the outward Ear to the *Membrana Tympani*.
- b The breaking off of the Bone, which makes the lower part of the Passage.
- 40 The *Musculus Externus Auris*. Vid. Fig. IV.
- c The Process of the *Malleus*, on the *Membrana Tympani*.
- d The *Membrana Tympani*, commonly call'd the Drum of the Ear.
- e The *Sinus* of the *Os Temporum*, for the Articulation of the *Processus Condylodes* of the lower Jaw.
- f The Suture or Conjunction of the *Os Sphenoides* with the *Os Temporum*.
- gg The Edges of the last named Bones saw'd off.
- h The Suture between the *Os Temporale* and *Sincipitis*.
- i A *Sulcus* in the *Os Temporum*, whence the *Digastrick* Muscle of the lower Jaw springs.

FIG. II.

The internal Surface of the same Bones, with the Organs of Hearing, represented in the preceding Figure.

- AA The inside of the lower part of the *Os Sincipitis*, next the Brain.
- aa The Furrows caused by the Blood Vessels of the *Dura Mater*.
- B Part of the *Os Occipitis*.
- bb The *Sutura Squamosa* of the *Os Temporum* with the *Sinciput* and *Occiput*.
- CCC The Surface of the *Os Temporum* next the Brain.

O o

D Part

EXPLANATION of the TABLES.

- D Part of the *Os Sphenoides*.
 - E Part of the *Os Jugale*.
 - F The *Os Petrosum*.
 - I The Probe in the *Ductus a Palato ad Aurem*.
 - c The Edge of the *Os Sphenoides*.
 - e The external semicircular Canal laid open.
 - f The internal spongy part of the Bone.
 - g The *Foramen* express'd at K in the preceding Figure.
- The remaining Parts of this Figure are explain'd in the References to Fig III.

FIG. III.

Part of the preceding Figure at f, G, H, 41, 42, magnify'd.

- a The *Ligamentum Vaginale* of the *Musculus Internus Auris*, slit open and turn'd down, to shew the inclosed Muscle.
- 42 The *Internus Auris*.
- b The Process of the *Os Petrosum*, on which the Tendon of the last named Muscle passes.
- C The Tendon of the said Muscle descending to its Insertion on the *Malleus*.
- B Part of the Handle of the *Malleus*.
- G The Head of the *Malleus*.
- H The *Incus*.
- I Its long Process, which is articulated with the *Stapes*, by the Mediation of
- K The *Os Orbiculare*.
- M Part of the *Stapes*, as it appears *in situ*.
- L The Tendon of the *Musculus Stapedis*.
- N The external semicircular Duct opened.

FIG. IV.

The four little Bones of the right Ear taken out with their Muscles.

- A The *Stapes*.
- B Part of the Handle of the *Malleus*.
- C The Tendon of the *Musculus Internus*.
- H The Head of the *Malleus*.
- I The long Process of the *Incus*.
- K The *Os Orbiculare*.
- L The short thick Process of the *Incus*.

FIG. V. VI. VII.

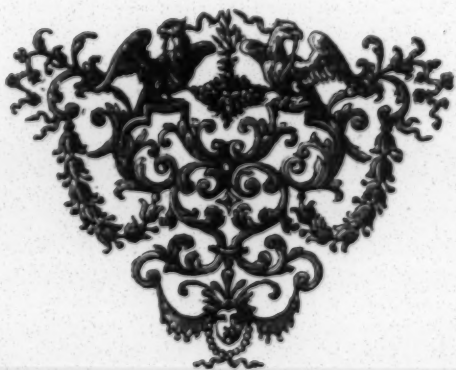
The Malleus, Incus, and Stapes, as big as the Life, and magnify'd.

- A The *Basis Stapedis*.
- a The Membrane in the hollow of the *Stapes*.
- b The *Sinus* on the Head of the *Stapes*, which receives the *Os Orbiculare*.
- C The *Sinus* of the *Incus*, which receives the *Malleus*.
- D That part of the *Malleus*, which is receiv'd by the *Incus*.
- B The Handle of the *Malleus*.
- E That part of the *Malleus*, where the Tendon of the *Musculus Internus* is inserted.
- F A Process of the *Malleus*, where it begins to adhere to the *Membrana Tympani*.
- G A slender long Process of the *Malleus*, to which the Tendon of the *Musculus Obliquus* is fastened.
- H The Head of the *Malleus*.
- I The long Process of the *Incus*, at the Extremity of which is
- K The *Os Orbiculare*, which is receiv'd in the Cavity of the *Stapes*, at *b*.

FIG. VIII.

The same Organs of the Left Ear magnify'd in the same Position, as in Fig. III. the Letters of Reference to both being the same, except that

- N Shews a Branch of the Auditory Nerve, in this Figure.



TAB. XXVII.

FIG. I.

The upper Surface of the Os Hyoides, when freed from its Muscles.

- A The fore Bone, called the *Basis* of the *Os Hyoides*.
 BB The two Extremities called *Cornua*, one of which in this Subject happen'd to be bent, as appears in the Figure.
 CC Two cartilaginous Appendices, from which
 DD Two Ligaments are continued to the Extremities of the Styloidal Processes.
 E Part of the Styloidal Process of the Right Side.

FIG. II.

The internal Surface of the same Os Hyoides.

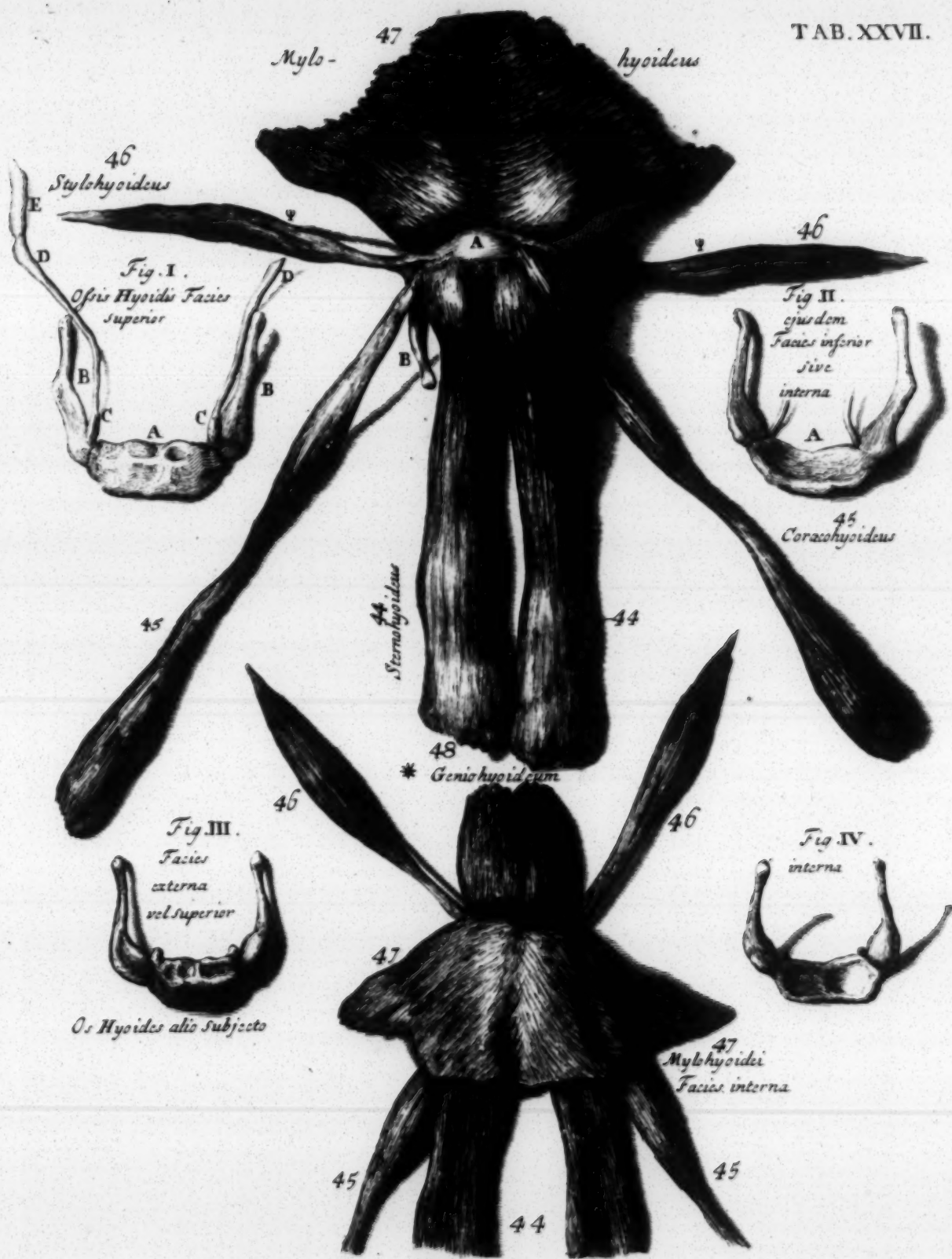
FIG. III. IV.

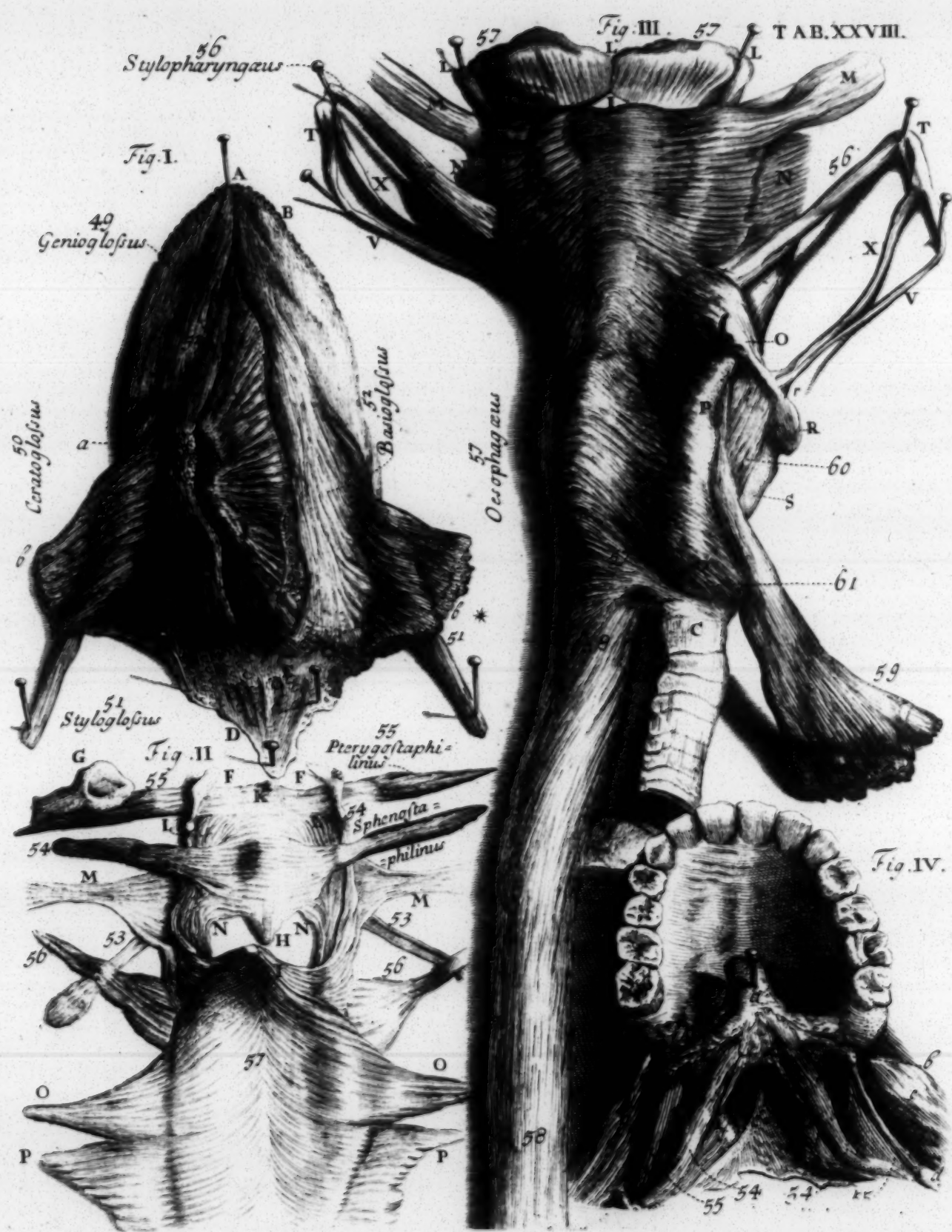
The internal and external Surfaces of the Os Hyoides from another Body.

The two other Figures represent the Os Hyoides taken out with its Muscles.

- A The fore Bone, or *Basis* of the *Os Hyoides*.
 B Its right *Cornu*.
 44. 44 *Par Sternohyoideum*.
 45. 45 *Par Coracohyoideum*.
 47. 47 The upper Figure shews the external Surface of the *Mylohyoideus*, the lower the internal Surface.
 46 The *Stylohyoideus*.
 † Its Perforation, by which passes the middle Tendon of the *Musculus Digastri-*
stricus of the lower Jaw.
 48 *Par Geniohyoideum*.







TAB. XXVIII.

FIG. I.

The Tongue, with its Muscles cut from their Originations, and left at their Insertions into the Body of the Tongue.

- 49 The *Genioglossus*.
 a The Origination of it, cut from the internal part of the Jaw-bone.
 50 The *Ceratoglossus*. bb The Originations of these Muscles cut from the *Cornua* of the *Os Hyoides*.
 51 The *Styloglossus*.
 52 The *Basoglossus*.
 A The Tip of the Tongue pinn'd out.
 B Part of its *Corpus Villosum*, as it appear'd on its Sides in this Position.
 CC The *Basis*, or Root of the Tongue.
 D The Membrane, that is continued from the Tongue on the *Epiglottis*, with its Salival Miliary Glands E, as they appear'd on its internal Surface. These Glands are very conspicuous in Oxen: You may see them on the *Epiglottis* of a dry'd Neat's Tongue, as its call'd, on which, I must confess, I first observ'd them, and afterwards discover'd them in human Bodies. When the Excretory Ducts of these (E) and the neighbouring Glands are obstructed, the Patient is oblig'd to swallow the Spittle very often to moisten these Parts; an Instance of which I found in a Gentleman, that is now my Patient, who has a hard Tumour on the upper part of the Scutiformal Cartilage of the *Larynx*.

FIG. II.

The back part of the Muscles of the Uvula, with the upper part of those of the Fauces, when dissected.

- FF The Extremities of the *Processus Pterygoidei* broken off, to shew the Progress of the Tendons of the *Musculi Pterygostaphylini* (55) over them on each Side.
 G The cartilaginous beginning of the Tube between the *Fauces* and the Ear, cut out, to shew its Connexion to the last mention'd Muscle, 55.
 H The hind part of the *Uvula*.
 I The back part of the *Fauces* pinn'd up.
 53 Part of the *Musculi Glossostaphylini*.
 54 The *Sphenostaphylini*.
 55 The *Pterygostaphylini*.
 K Their Tendons separated from the *Os Palati*.
 LL The Fibres of that part of the *Musculus Oesophagus*, which springs from the last mention'd Tendons on each Side, and the Extremities of the *Processus Pterygoidei*. This I formerly call'd *Pterygopharyngæus*; but finding it so complicated

P p

cated

EXPLANATION of the TABLES.

cated with the *Oesophagæus*, I choose to represent it under that Title, being willing to retrench, as much as possible, the number of the Muscles, especially such as are not fairly to be separated from each other.

MM Another part of the *Musculus Oesophagæus*, which springs from the lower Jaw-bone.

NN A third Series of Fibres of the *Oesophagæus*, springing from the *Uvula*, and ending in the Sides of the *Fauces* and Scutiform Cartilage. *Vid.* Tab. XXIX. Fig. I. and II. N. N.

OO A fourth part of the *Oesophagæus*, that arises from a Cartilaginous Appendix of the *Os Hyoides*. *Vid.* Fig. III. O, and Tab. XXIX. Fig. II.

PP Another part of the *Oesophagæus*, that comes from the Sides of the Scutiform Cartilage, express'd at P, Fig. III.

FIG. III.

The back part of the Muscles of the Fauces, connected to the Os Hyoides and Larynx.

C The Cartilaginous Rings of the *Larynx*.

D Its back part, which is membranous, to give way for the Dilatation of the *Oesophagus* in swallowing.

LLL That part of the *Oesophagæus*, that springs from the *Processus Pterygoidei*, the Tendons of the *Musculi Pterygostaphylini*, and the *Os Occipitis*, and has a different Order of Fibres from its external ones express'd at I, which are connected to the middle of the anterior *Appendix* of the *Os Occipitis*.

MM Those parts of the *Oesophagæus*, that arise from the lower Jaw.

NN Its Fibres, that spring from the Root of the Tongue.

O From the *Os Hyoides*.

P From the Scutiform Cartilage.

Q From the *Cartilago Cricoides*.

R The *Os Hyoides*. r. Its Cartilaginous Appendix.

S The *Cartilago Thyroides*.

T The *Processus Styloides*.

VV Two Ligaments fastened to the Extremities of the *Processus Styloides* and Cartilaginous Appendices of the *Os Hyoides* on each Side.

XX A pair of Muscles, most commonly found springing fleshy from the *Processus Styloides*, and terminating in the Cartilaginous *Appendices* of the *Os Hyoides*, r.

56 The *Stylopharyngæi*, with their Originations from the *Processus Styloides* and their Insertions into the *Pharynx*.

57. 57. The back part of the *Oesophagæus*.

58. 58. The external Surface of the *Vaginalis Gulae*, as it appears, when distended with Wind.

EXPLANATION of the TABLES.

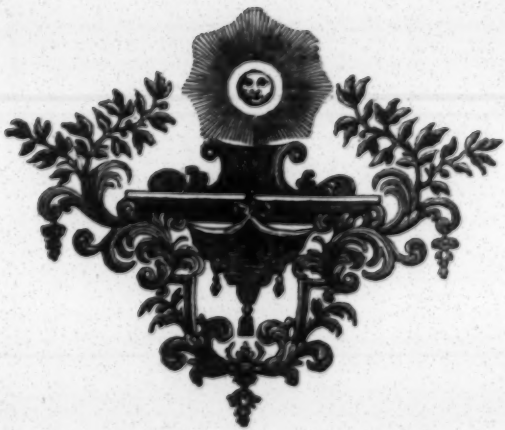
147

- 59 The *Sternothyroideus* left at its Implantation into the *Cartilago Thyroides*.
60 The *Hyothyroideus in Situ*.
61 The *Cricothyroideus in Situ*.

FIG. IV.

The Muscles of the Uvula, clear'd and left in their natural Situation.

- a* The Uvula pinn'd up.
bb The *Processus Pterygoideus* bar'd.
c A Ligament, which is continu'd from the Extremity of an acute Process of the *Os Sphenoides*, *d*, to the *Processus Pterygoideus*.
e The *Septum Narium*.
ff The Cartilaginous Extremities of the Tube, between the Palate and Cavity of the *Tympanum*.
g Part of the *Musculus Pterygoideus Internus* of the lower Jaw.
54 The *Sphenostaphylinus*.
55 The *Pterygostaphylinus*.



TAB.

TAB. XXIX.

FIG. I. II.

The fore Parts of the Muscles of the Uvula and Fauces dissected and cleared of their Glandulous Membranes.

FGH The fore Parts of the same Organs explain'd in the preceding Table at F. G. H. Fig. II.

H Fig. II. The back part of the *Uvula*, here seen by its being pinn'd up.

II The internal Series of fleshy Fibres of the *Oesophagus* Muscle, that arise from the *Appendix* of the *Os Occipitis*, and decussate the external Fibres, express'd Fig. II. and III. of the foregoing Table, at I, I, 57, 57. These Fibres are join'd with others springing from the Tendons (K) of the *Pterygostaphylini*, at L L, from the lower Jaw, at MM, and *Uvula*, at NN.

53 The *Glossostaphylinus*, with part of the Tongue remaining.

54 The *Sphenostaphylinus*.

55 The *Pterygostaphylinus*.

56 The *Stylopharyngæus*.

57: 57 The *Oesophagus*. Those Parts of it which decussate the Fibres at I, L, M, and N, arise at O from the Cartilaginous *Appendices* of the *Os Hyoides*, and its Extremities; at PP, from the *Cartilago Thyroides*; at Q, from the *Cricoides*.

58 Part of the *Vaginalis Gulae*.

R The internal Membrane of the *Gula*, which makes the *Glottis*, supported on a Pin.

SS The *Amygdalæ*, or *Tonsillæ*.

T Some small Glands left, on taking off the internal Membrane, to shew the Series of Fibres underneath.

VV The Glandulous Body of the Palate, cut from the *Os Palati*.

FIG. III.

The Gula distended with Wind, to shew

58 The *Vaginalis Gulae*.

A Its external Surface, compos'd of Fibres passing somewhat obliquely, according to its Length.

BB Its internal circular Fibres.

CC The external and internal Fibres rais'd, to shew their Decussation.

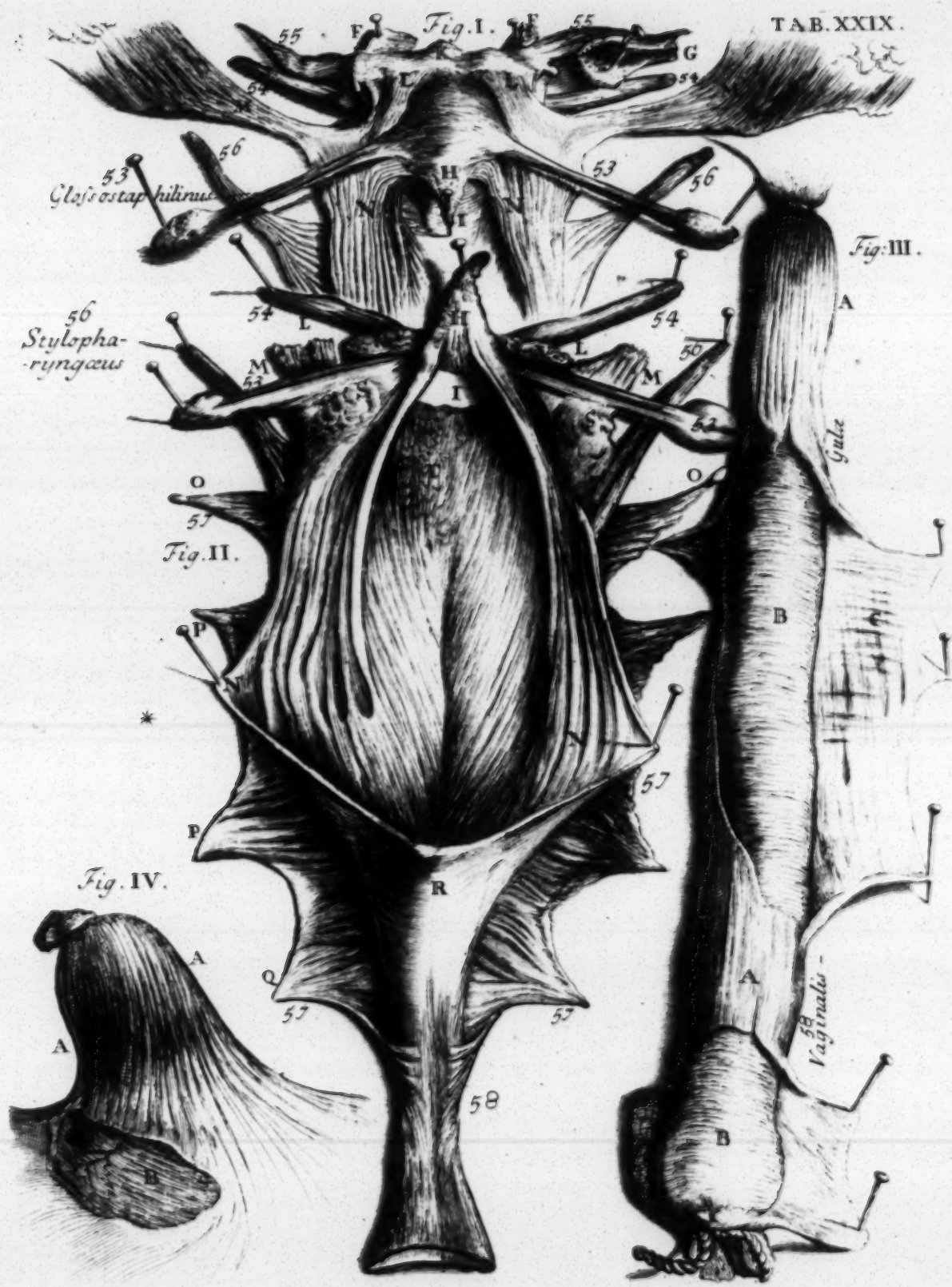
FIG. IV.

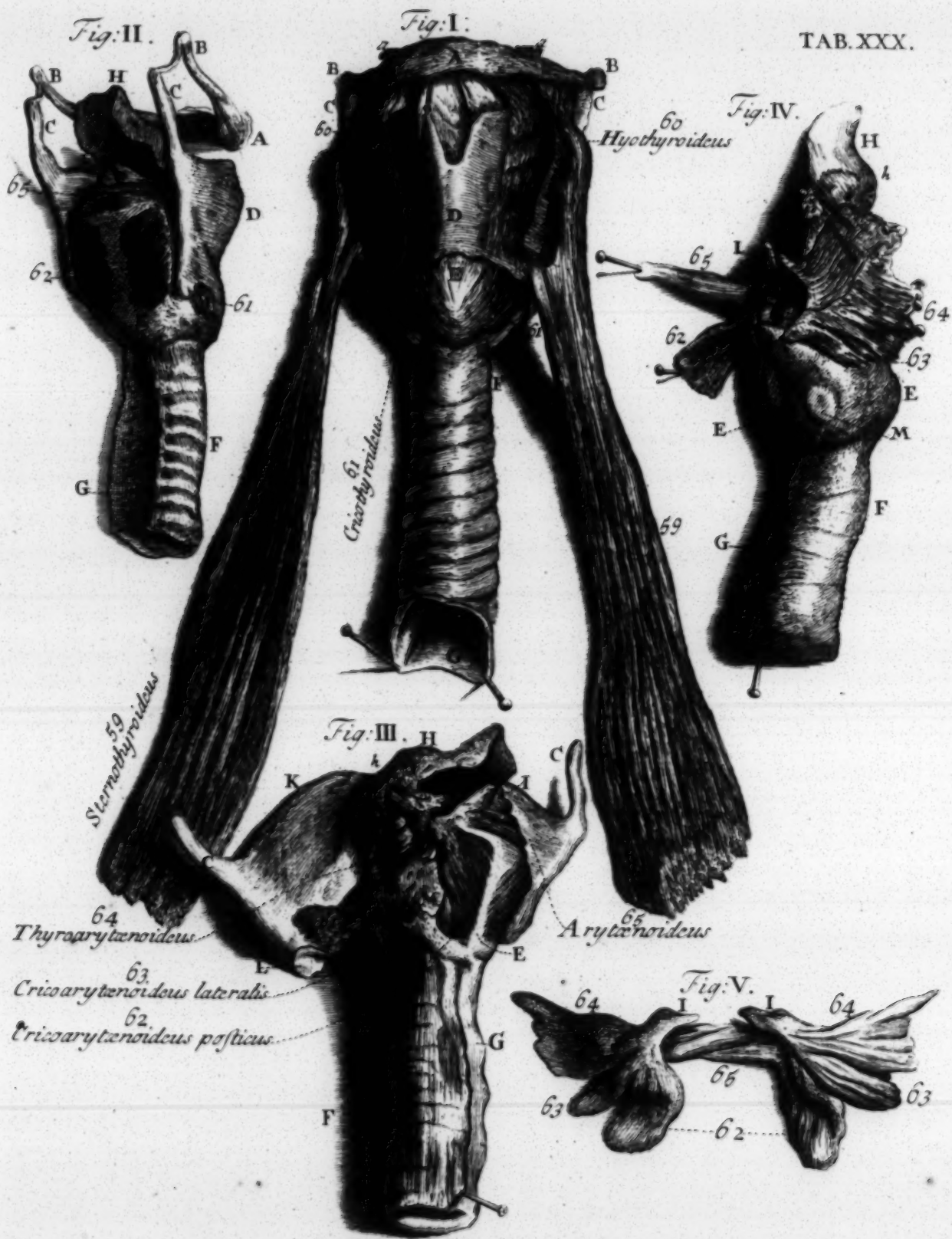
The Musculus Vaginalis Gulae, ending on the Left Orifice of the Stomach.

AA Its external Fibres.

B Its internal Fibres still crossing the former on the Stomach.

TAB.





TAB. XXX.

FIG. I.

The fore part of the Larynx, with the Os Hyoides and part of the Wind-pipe annex'd, together with all the common Muscles of the Larynx.

A The *Os Hyoides*.

aa Its Cartilaginous *Appendices*.

BB The Extremities of the *Cornua* of the *Os Hyoides*.

CC The Processes of the Scutiform Cartilage. *Vid.* Fig. II.

D The external and fore part of the *Cartilago Scutiformis*.

E The *Cartilago Cricoides*, or *Annularis*.

F The Semicircular Cartilages of the Wind-pipe, which in this Subject (being an emaciated morbid Body) was drawn down to the right Side, by means of a large Ulcer on that Side of the Lungs, that caused the Lobes to adhere to the *Thorax* entirely on that Side.

G The Membranous Substance on the back part of the Wind-pipe, that is next the *Gula*.

59 The *Sternothyroideus*, cut from its Origination, and left at its Infertion on each Side.

60 The *Hyothyroideus*, which on the right Side in this Subject was double, as appears in the Figure.

61 The *Cricothyroideus in Situ*. In Fig. III. it is raised from the Cricoidal Cartilage, and left at the Thyroidal.

FIG. II. III. IV. V.

Shew different Views of the Larynx, and its proper Muscles.

A, B, C, D, E, F, and G are placed on, or by the same Parts, in different Views, with Fig. I. except that G, in Fig. II. shews the external Glandulous Surface of the Membrane of the *Aspera Arteria* next the *Gula*.

H The *Epiglottis*.

b Its Root, cut from the Basis of the Tongue, where many small Glands appear on it, which are very conspicuous in the *Epiglottis* of an Ox.

I The Tips of the Arytænoidal Cartilages, here bared of that Membrane, which on these Parts frames the *Glottis*.

K Fig. III. The internal concave Surface of the Thyroidal Cartilage.

Q q

L Fig.

EXPLANATION of the TABLES.

L Fig. III. The lower short Process of this Cartilage, on the Left Side, freed from its Connexion to the Cricoidal Cartilage express'd at M.

62 The *Cricoarytænoideus Posterior in Situ*, Fig. II. and III. In Fig. IV. it is rais'd from the Cricoidal Cartilage, and pinn'd out.

63 *Cricoarytænoideus Lateralis in Situ*, Fig. III. and IV.

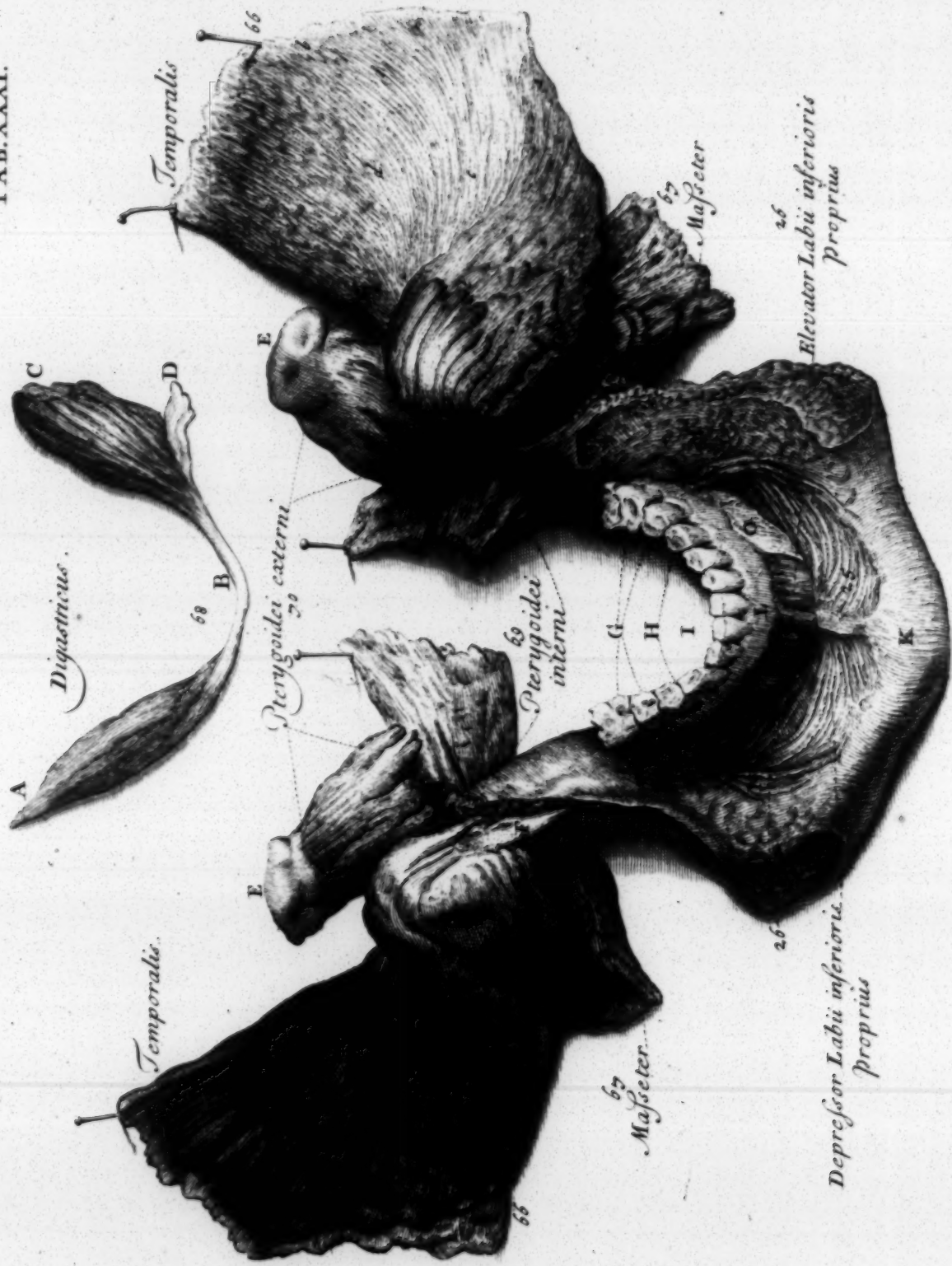
64 *Thyroarytænoideus, in Situ*, Fig. III. In Fig. IV. it is cut from its Origination, and left at its Insertion.

65 The *Musculus Arytænoideus, in Situ*, Fig. II. and III. rais'd and pinn'd out in Fig. IV.

In Fig. V. all the last named Muscles are dissected, and left at their Terminations on the Arytænoidal Cartilages.



TAB. XXXI.



TAB. XXXI.

The Muscles of the lower Jaw, as they appear, when freed from the Cranium.

66 The Insides of the Temporal Muscles, where may be seen divers fleshy Fibres of them, as they appear, when cut from the *Os Frontis*, at a, *Sincipitis*, at b, *Sphenoides*, at c, *Temporale*, at d, and *Os Jugale*, at e.

67 The internal Surface of the Masseter.

68 The *Digastricus*.

A Its Origination from the Chink by the back part of the *Processus Mam-miformis*.

B Its middle Tendon, which is braced down by an annular Ligament fastened to the *Os Hyoides*.

C Its Termination, cut from the lower Jaw.

D Some tendinous Fibres of this Muscle, cut from the *Os Hyoides*.

69 The internal Surfaces of the *Pterygoidei Interni*.

70 The *Pterygoidei Externi*, hanging down from

EE the Condylodal Processes of the lower Jaw.

FF The *Processus Acutus*, or *Corone*, partly seen.

G The *Dentes Molares*, which remain'd in this Subject.

H The *Canini*.

I The *Incisores*.

K The lower Lip turned down, to shew the Glandulous and Muscular Texture of its inside.

L The Gums of the lower Jaw.

M The Labial, or Buccal small Salival Glands, as they appear on the Left Side, after the internal Membrane of that part is raised. The Membrane on the other Side here express'd remaining on.

N Branches of the *Par Quintum Nervorum*, accompanied with Blood Vessels of both kinds, passing the Perforations on each Side the lower Jaw, after giving Branches to the Teeth. They distribute themselves on the Lips, especially the lower Lip, as here express'd.

OO The fore part of the lower Jaw bared.

25 The inside of the *Depressor Labii Inferioris*.

26 The *Elevator Labii Inferioris in Situ*.

TAB. XXXII.

71 The Inside of the *Serratus Minor Anticus*.

A Its Origine, cut from the *Processus Coracoides* of the *Scapula*.

BBB Its three fleshy Digitations, that terminate on the second, third and fourth Ribs, in the manner you see the Ends of the fleshy Fibres here express'd, cut off, † † †.

72 The Inside of the *Serratus Major Anticus*.

AC That part of it, that springs from the *Basis Scapulae*, below its Spine: from A to D is that part, that has its Origine above the Spine of the *Scapula*.

B The upper part of this Muscle, which is seen between the *Cucullaris*, *Scale-ni*, *Levator Scapulae*, and *Clavicularis*, as express'd Tab xxii. at 72.

EF The Digitations of this Muscle, cut from the 8th, 7th, 6th, 5th, 4th, and 3d Ribs.

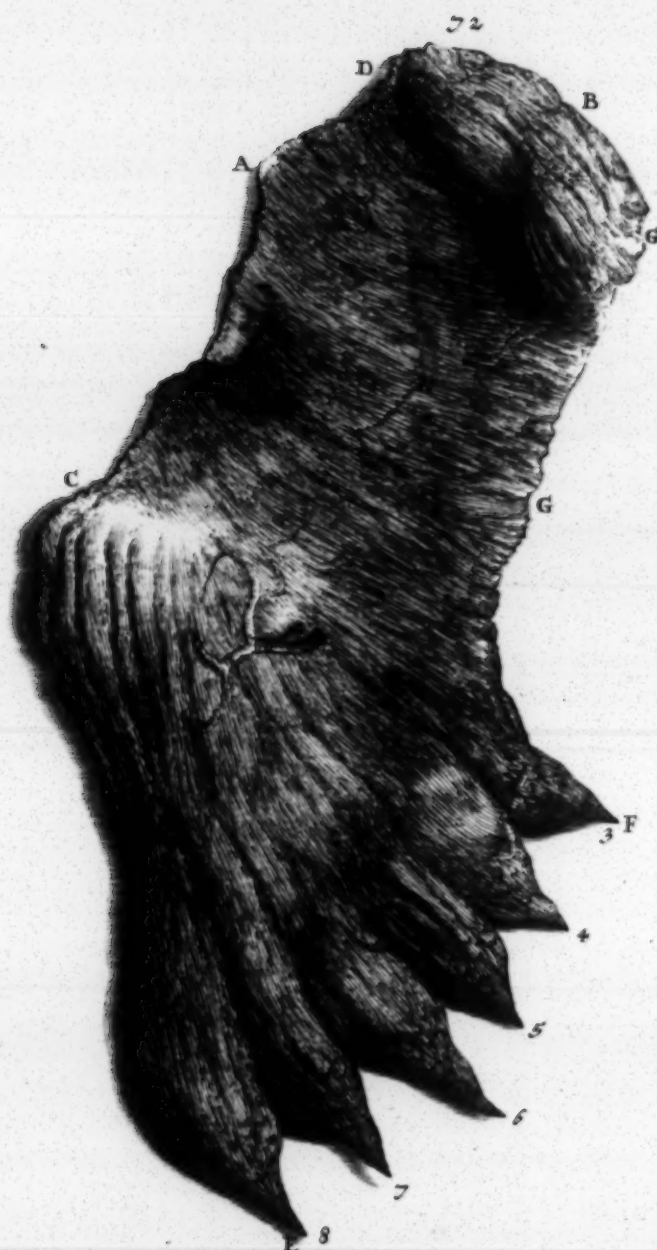
GG That part of it, which terminated on the first and second Ribs.

H Its Arteries, filled with Wax.

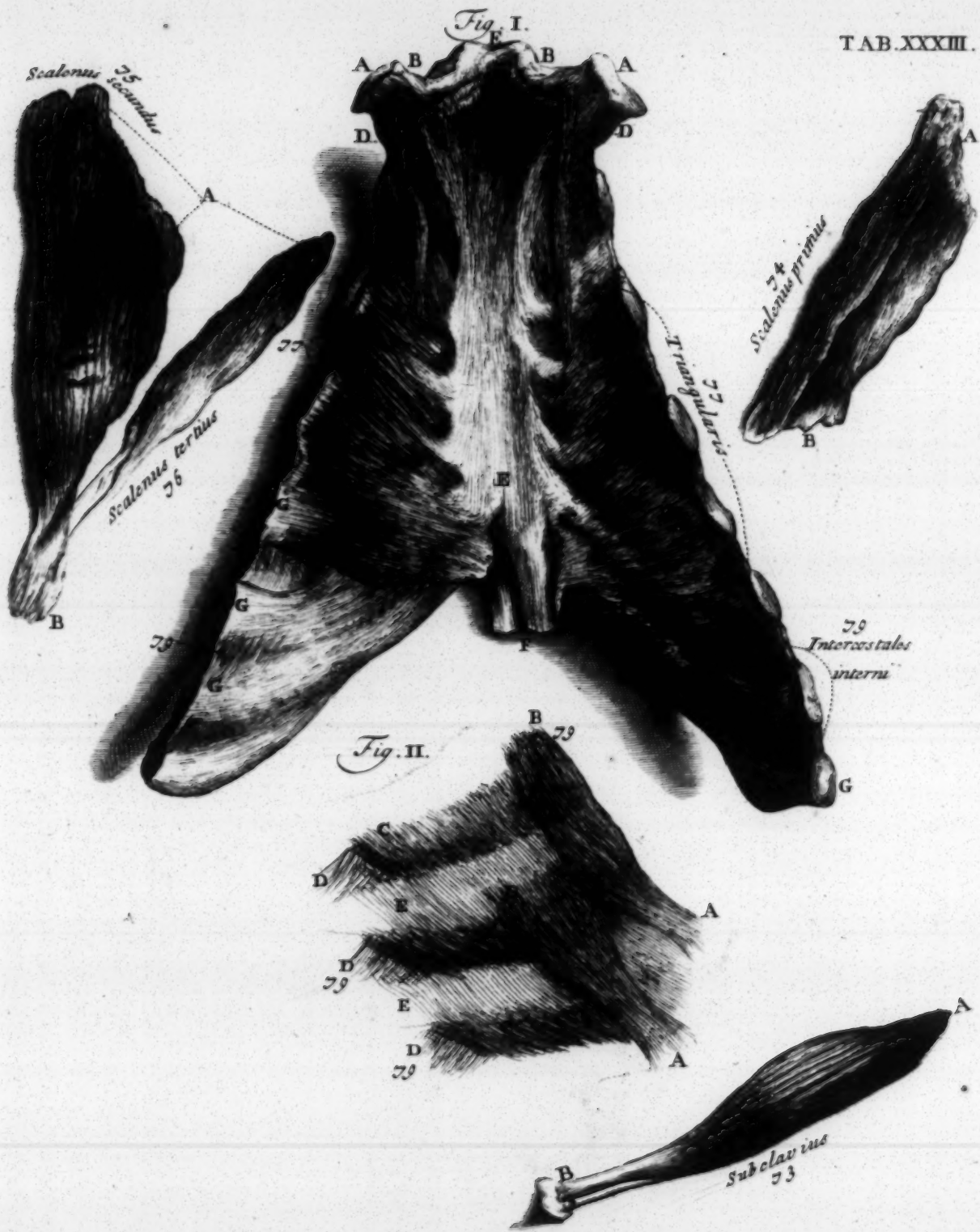




71
Serratus minor
Anticus



72
Serratus major
Anticus



TAB. XXXIII.

73 The *Subclavius* dissected.

A The fleshy Part of it, that springs from the *Clavicula*.

B Its round Tendon, with part of the Cartilage of the first Rib cut off.

74 The Inside of the *Scalenus Primus*.

A Its fleshy Origine from the fourth, fifth, and sixth transverse Processes of the Neck.

B Its Termination, cut from the first Rib.

75, 76 The Outsides of the *Scalenus Secundus*, and *Tertius*.

A Their fleshy Beginnings from the third, fourth, fifth and sixth transverse Processes of the *Vertebrae* of the Neck.

B Their common Tendon in this Subject, cut from the first Rib.

FIG. I.

The Inside of the Sternum, with the Cartilaginous Endings of the Ribs, freed from their Bony Parts.

AA The Cartilaginous Endings of the two upper Ribs, which are constantly longer than the two next below them, as here express'd.

BB Two Sinus's, where the Extremities of the *Claviculae* are articulated, by the mediation of two moving Cartilages.

CC Part of the *Par Sternothyroideum*.

DD The Mammary Arteries and Veins.

EE The Inside of the *Os Pectoris*, or *Sternum*.

F The *Cartilago Ensiformis*.

GG The Cartilaginous Endings of the Ribs, cut from their Bony Parts.

77 The *Musculus Triangularis*, on each Side.

79 The internal Intercostal Muscles.

H Part of the Diaphragm.

FIG. II.

A Sketch of the internal Surface of two or three of the lower Ribs, near their Articulations with the Vertebrae of the Back, as big as the Life; where a Disposition of the internal Intercostal Muscles, not commonly taken notice of, is represented.

79, 79 The *Intercostales Interni*.

AA The tendinous Original of divers Slips of the internal Intercostal Muscles, springing from the inferiour Ribs, and ascending obliquely over the next superiour Rib at E, where they become broader and fleshy, being join'd with fleshy Slips from the subjacent intercostal Muscles at C, and terminating in the next Rib above at B.

This Disposition of the internal Intercostal Muscles is continued on all the Ribs, on both sides the *Thorax* in human Bodies, and not in those *Quadrupeds*, that I have hitherto examin'd. The way of discovering this, is by raising the *Pleura*, which may easily be done by your Fingers, after it is divided from the *Mediastinum*, on the Bodies of the *Vertebrae* of the *Thorax*.

DD Parts of the external Intercostal Muscles, bared from the Internal.

R r

TAB.

TAB. XXXIV.

78 The upper Surface of the Diaphragm, next the *Thorax*.

A The Right Side.

B The Left.

C That part of the Diaphragm, which arises from the *Cartilago Ensiformis*.

DEF Those Parts, that arise from the *Vertebrae* of the Loins.

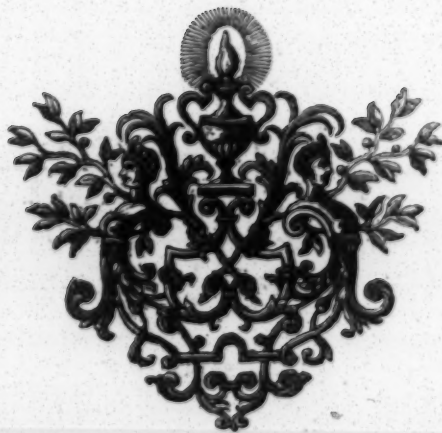
GG From the two last Ribs.

HH From the Cartilaginous Endings of the Ribs next the *Abdomen*; whence its fleshy Fibres pass, till they become tendinous, II, where they decussate each other in various Angles, according to their several Directions, from their different Originals at A, B, C, D, E, F, G, H. Nor do they seem to terminate here, but each tendinous Fibre is continued to its opposite fleshy one, making as it were so many Digastrick Muscles, in which are two considerable Perforations; the one for

K The *Vena Cava*, the other for

L The *Gula*.

M A Portion of the Trunk of the *Arteria Magna*, in the Fissure of the two Productions of the Diaphragm, where the *Vena sine pari* and the Thoracick Duct also pass.





Diaphragma

78.

T AB. XXXIV.



TAB. XXXV.

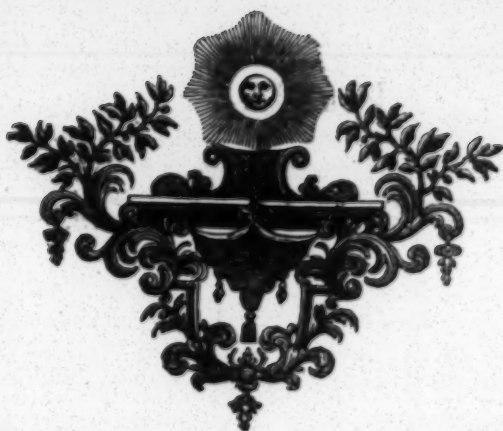
78 The lower Surface of the Diaphragm, next the *Abdomen*.

A, B, C, D, }
E, F, G, H, } Are describ'd in the Explication of the preceding Table.
I, K, L, }

M The Fissure, made by its two Productions, in which passes the descending Trunk of the *Arteria Magna*, &c.

NN The Phrenick Veins and Arteries, fill'd with Wax.

O Some Phrenick Arteries, that spring from the Intercoastal Arteries.



TAB. XXXVI.

Divers Views of the external, middle, and internal Compages of the Fibres of the Heart.

FIG. I.

The fore part of the Heart, next the Sternum.

- A The inferiour Trunk of the *Vena Cava*.
- B The *Arteria Pulmonalis*.
- C, C, C The *Vena Pulmonalis*, with its Branches tied up.
- D The *Arteria Magna*.
- a The *Ligamentum Arteriosum*, between the Pulmonick Artery and the *Aorta*.
- b The Trunk of the *Arteria Coronalis*.
- E The right Auricle distended, to shew the Series of its Muscular Fibres.
- F The Left Auricle,
- G The oblique descending Progres of the Muscular Fibres of the right Ventricle of the Heart.
- H The oblique ascending Progres of the carnos Fibres of the left Ventricle.
- II The tendinous Union of both these on the *Septum* of the Heart.

FIG. II.

The back part of the Heart, next the Vertebrae.

- A The lower, or ascending, Trunk of the *Vena Cava*.
- aa The circular Fibres appearing on its inside.
- B A Portion of the upper, or descending, Trunk of the *Cava*.
- b The *Vena Coronaria*.
- C The *Vena Azygos* tied up, where it discharges it self into the *Cava*.
- DD The right Auricle, representing the various Disposition of its Fibres.
- E Part of the Root of the left Auricle *in Situ*.
- G The Muscular Fibres on the bulbous Trunk of the *Vena Pulmonalis*.
- FF Two of its Ramifications from the Lungs, tied up.
- H The Fibres of the right Ventricle.
- I Those of the left Ventricle.
- KK Their tendinous Union, on the *Septum Cordis*.
- L The *Foramen Ovale*, somewhat appearing.

FIG.

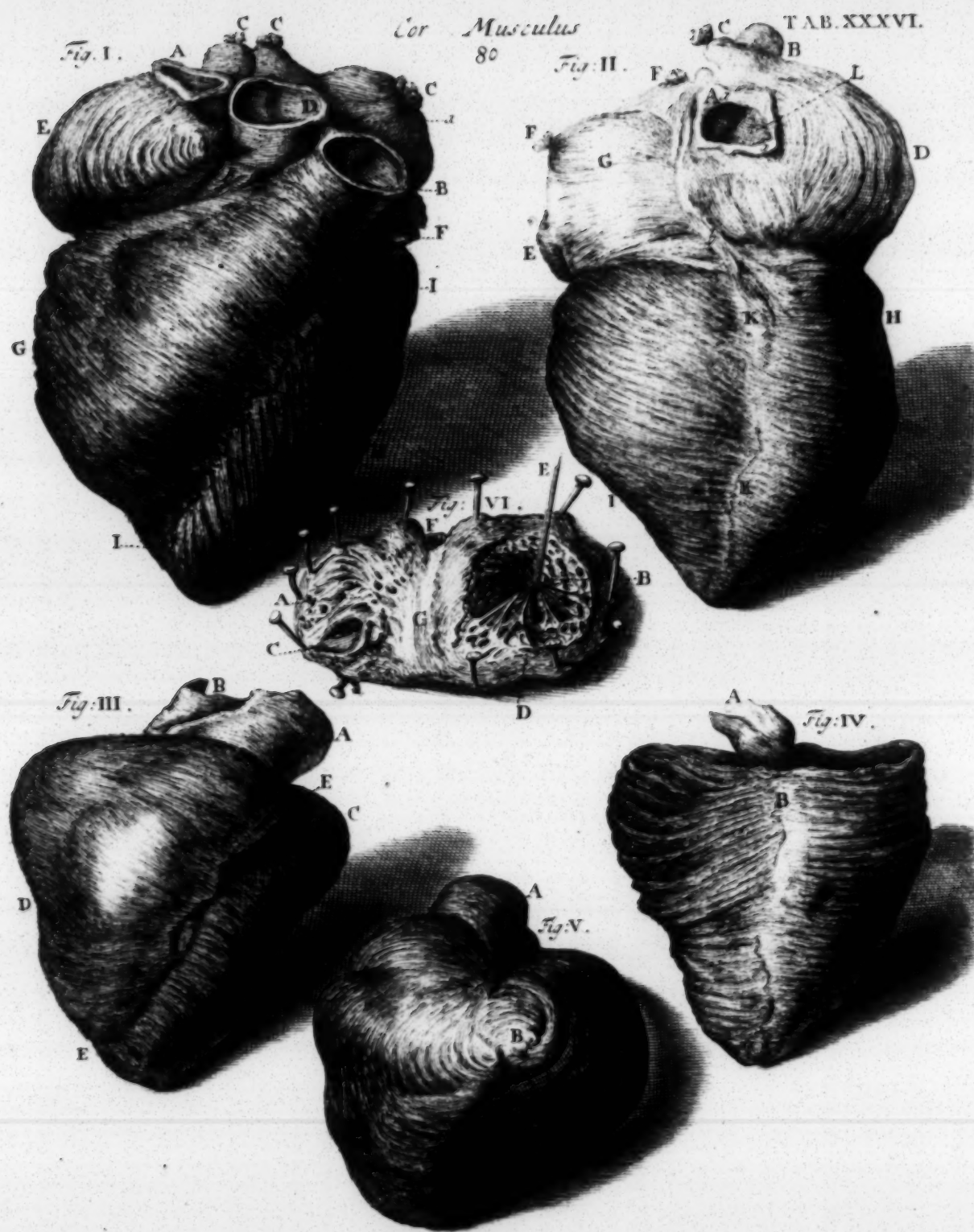


FIG. III.

The Series of Fibres, under those represented in Fig. I.

- A Part of the *Arteria Pulmonalis*.
- B A Portion of the *Aorta*.
- C The Fibres of the left,
- D Those of the right Ventricle of the Heart.
- EE The tendinous Union of the carnos Fibres of both Ventricles.

FIG. IV.

The Fibres, as they appear, under those express'd in Fig. II.

- A Part of the *Aorta*.
- B The tendinous Union of the Fibres of both Ventricles.

FIG. V.

The Double Spiral Order of the Fibres, at the Cone of the Heart, which may partly be seen in Fig. III.

- A Part of the *Arteria Pulmonica*.
- B The Contortion of the Fibres, at the Cone of the Heart.
- CD The tendinous Union of both Ventricles.

FIG. VI.

A View of the internal Surface of the Cone of the Heart, after a transverse Section.

- A The Bottom of the right Ventricle.
- B That of the left.
- C The Thickness of the Sides of the right Ventricle.
- D That of the left.
- E A Thread, supporting the tendinous Fibres, that pass from one Side of the left Ventricle to the other.
- F The Trunks of the Coronary Vein and Artery divided.
- G The tendinous Union of both Ventricles.

TAB. XXXVII.

FIG. I.

The right Auricle and Ventricle of the Heart, open'd from the Vena Cava.

- A The Body of the Heart, with its Blood Vessels filled with Wax.
 a Its Cone.
 BB The ascending Trunk of the *Vena Cava* opened.
 bb That part of the right Auricle, that is divided from the ascending Trunk of the *Cava*.
 C The descending Trunk of the *Cava*, also open'd and expanded.
 c The Orifices of Veins, that bring Blood from the Auricles, and Trunks of Blood Vessels at the *Basis* of the Heart.
 DD The Inside of the right Auricle.
 d A small Semilunar Valve, as it appears in the lower Trunk of the *Vena Cava*, in this Position. See Fig. II.
 EEE The Sides of the right Ventricle divided.
 F One of the carnos Columns, to which the Tricuspid Valve is fasten'd.
 f Some fleshy Fibres passing from the inside of the Ventricle to the Tricuspid Valve.
 GG The Tricuspid Valve, as it appear'd in this Position.
 H A Valve pinn'd up, at the Orifice of the Coronary Vein.
 II A bended Probe, passing through the *Foramen Ovale*, K, into the *Vena Pulmonalis*, L, which remain'd open in this Subject, who died consumptive about 30 Years of Age.
 MM A Black Lead Pencil, supporting the Tricuspid Valve, and passing out at the right Branch of the *Arteria Pulmonalis*, N.
 O The left Branch of the *Arteria Pulmonalis*.
 P Divers carnos Fibres, which arising from the *Septum Cordis*, pass to the opposite Side of the right Ventricle, and draw it close to the *Septum*, when the Heart is in *Systole*.

FIG. II.

A Portion of the lower Trunk of the Vena Cava, dissected and display'd, with the Parts annex'd, to shew the Valve express'd at d, Fig. I.

- AA The Trunk of the *Vena Cava*, cut off immediately above the Liver, at its passing the Perforation of the Diaphragm.
 B A Portion of the Diaphragm.
 C, C Two Pins, with Threads passed through the Edge of the Semilunar Valve, as I call it from its Figure in this and most other Subjects, to shew the Extent of this Valve.

EE Part



EE Part of the *Cava* cut from the *Basis* of the Heart.

D The *Vestigium* of the *Foramen Ovale*, which in this Subject, tho' very young, was closed.

FIG. III.

Shews the same Valve, express'd in the two former Figures, at d, and CC, as I found it in the Vena Cava of a Man near 80 Years of Age, in whom I first observ'd it, done from a dried Preparation, which I have now by me.

AA The Trunk of the *Vena Cava*, cut off immediately above

BB The Diaphragm.

CC The Valve, which in this Subject appears, as here express'd, full of Perforations of various Sizes and Figures.

D A lucid Membrane not perforated, in the place of the *Foramen Ovale*.

EE The Trunk of the *Vena Pulmonalis* open'd and expanded.

a The Orifice of a large Vein, that empties it self into the *Vena Cava*, near the right Auricle.

b The Branches of Arteries, from whence the Blood is received, that is discharg'd by the Vein last mention'd.



TAB. XXXVIII.

FIG. I.

The same Heart, represented at Fig. I. in the preceding Table, with the right Ventricle open'd from the Arteria Pulmonalis, both being here pinn'd out and display'd, as big as the Life.

A The external Surface of the Heart, near its Cone, with its Blood Vessels (a a a) fill'd with Wax.

BB The Sides of the right Ventricle, divided and pinn'd out, to shew its internal Surface, leading into the *Arteria Pulmonalis*.

CC The Trunk of the Pulmonick Artery open'd, and in like manner expanded.

D, E Its right, and left Branches, also open'd and cut off at their Entrance into the Lungs.

ccc The three Semilunar Valves, one of which is supported with a Probe.

d A large fleshy Column, arising from the opposite Side of the right Ventricle, here supported on the Head of a large Pin, f, to shew its Tendons passing to the lower Margin, and sides of the Tricuspid Valve, c.

By means of the several *Foramina*, Fissures, and fleshy Columns, in this Ventricle, its Sides contract the closer in the *Systole*, in order to the better Expulsion of its contain'd Blood into the Arteries of the Lungs.

F The Trunk of the *Aorta* cut off.

G The Descending Trunk of the *Vena Cava*.

H Part of the right Auricle.

FIG. II.

The Mitral Valve of the left Ventricle, dissected and display'd.

a The upper part of the Valve, freed from its connexion to the *Basis* of the Heart, at the Orifice of the *Vena Pulmonica*.

bb Its lower Margin, which hangs down into the Cavity of the left Ventricle, to which some Tendons, as here express'd, arising from the carnos Columns, are fast'ned; which Tendons, being equal in length with those, that pass to the middle and upper part of the Valve, at ee, must admit of the lower Edges of this Valve to fold on each other, whereby the Orifice of this Valve is effectually closed, when the Heart is in *Systole*, while the middle and upper part of the Valve, at ee, is drawn down with the *Basis* of the Heart, towards its Cone.

ccc The *Columnæ Carneæ*, cut from the Sides of the Ventricle; from which the above-mention'd Tendons arise.

dd Two of the transverse Tendons, between the carnos Columns.

FIG.

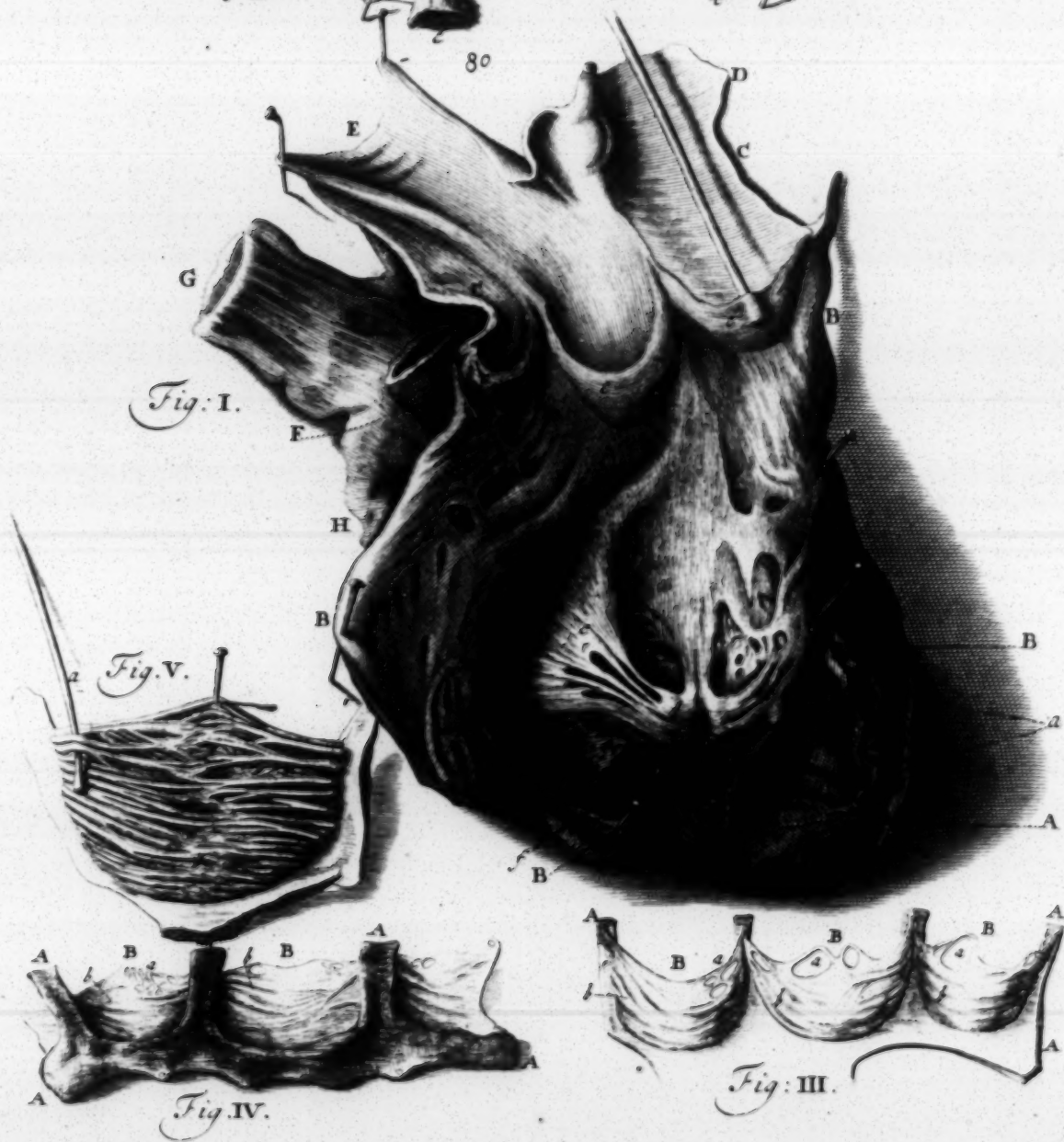


FIG. III.

The internal Surface of the three Semilunar Valves of the Pulmonary Artery, next the Cavity of the right Ventricle of the Heart.

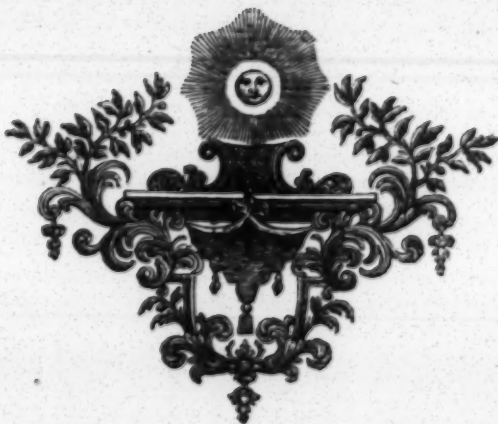
FIG. IV.

The external Surface of the same Valves, next the Trunk of the Pulmonick Artery.

AA Parts of the Artery left, after the rest are cut away, to shew the Structure of the Valves.

BB The Valves as I have frequently found them, with Perforations of various Sizes, a a.

bb The carnous *Fibrillæ* of these Valves, which appear almost as plain, as here express'd, to the naked Eye; but on the external Surface of these Valves in an Ox, *i. e.* next the Trunk of the Artery, you will find these carnous Fibres variously interwoven, and such large muscular Bodies, that you may thrust a Probe underneath them, without wounding the internal Surface of the Valve, as express'd at a. Fig. v.



TAB. XXXIX.

FIG. I.

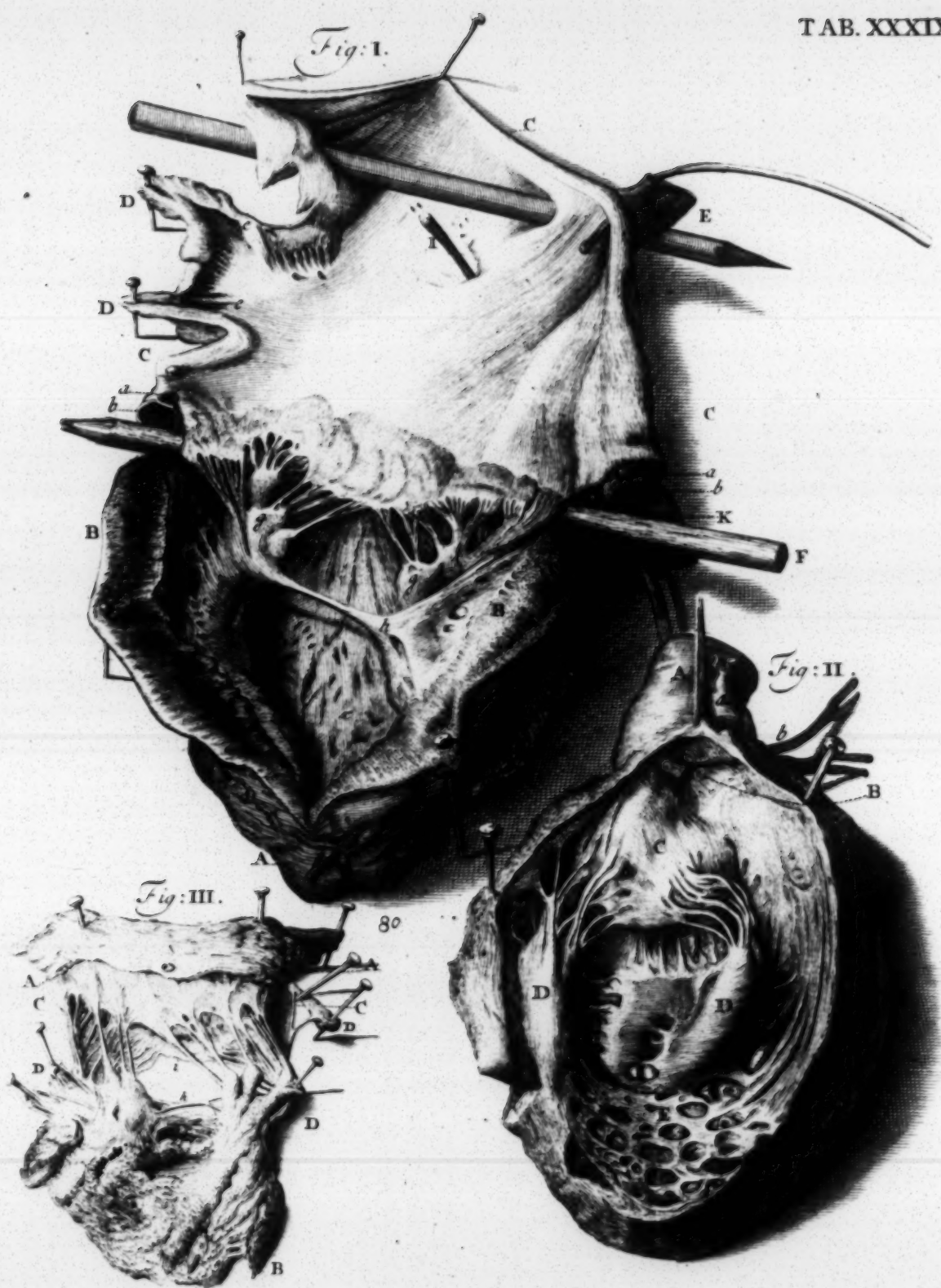
The Left Ventricle of the Heart open'd, with the Trunk of the Vena Pulmonalis, and the Left Auricle.

- A The Cone of the Heart.
 BB The Sides of the Left Ventricle divided, to shew its internal Surface.
 ab The Trunks of the Coronary Veins and Arteries, fill'd with Wax, and cut through, at the *Basis* of the Heart.
 CC The Trunk of the Pulmonick Vein, divided and expanded.
 DD The Left Auricle of the Heart, partly open'd, at e e, to shew its internal Surface.
 E A small Probe, and a Pencil inserted into the Branches of the Pulmonick Vein.
 F Another Pencil supporting the Mitral Valve.
 gg The Muscular Columns, which send Tendons to the Valve.
 h A tendinous Production from each Carnous Column, which not only serves for approaching those Parts nearer to each other in the *Systole*, and straitning the Cavity of the Ventricle, in order to expel the Blood into the *Aorta*; but in the *Diastole* of the Heart it prevents too great a Dilatation of the Sides of the Ventricle, by the influent Blood.
 i The way the Blood passes to the *Aorta*, behind the Mitral Valve.
 I A Probe passing the *Foramen Ovale*, between the Right Auricle and *Vena Pulmonalis*.
 K Part of the *Vena Cava*.

FIG. II.

The external Paries of the Left Ventricle, cut off from the Basis of the Heart, at the Root of the Arteria Magna, to the Cone, according to the length of the Heart.

- A The Beginning of the *Arteria Magna*.
 ab Some of the Trunks of the two Coronary Arteries, freed from the Heart and cut off.
 B The Valves of the *Aorta*, as they appear'd towards the Left Ventricle.
 C The outside of part of the Mitral Valve, with the Tendons deriv'd from the two *Columnæ Carneæ* variously terminating on it, as is express'd Fig. II. of the preceding Table.
 DD The *Columnæ Carneæ*, deriving their Origine from a Center on the Side of the Left Ventricle of the Heart next its *Septum*, at E, whereby they not only draw the part of the Mitral Valve here express'd towards the *Septum*, and consequently bring this Side of the Mitral Valve to the other, but by this means make way for the Blood to pass out at the *Aorta*, as may be easily conceiv'd by this Figure. Besides the



the Tendons sent from the *Columnæ Carneæ* to the Mitral Valve, we meet with many other Tendons, also sent from the Carnous Columns to the Sides of the Ventricle; particularly some pass up to the *Basis* of the Heart, as may be seen in this Figure.

FIG. III.

The Mitral Valve taken out entire, with the Columnæ Carneæ and their annex'd Tendons, &c.

AA The fleshy Fibres at the *Basis* of the Heart cut off.

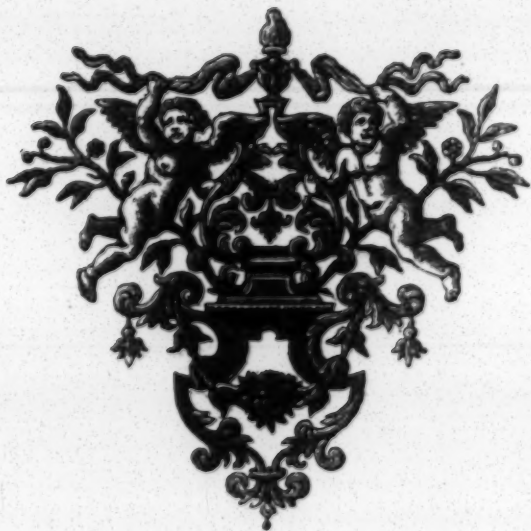
B Part of the fleshy Fibres cut from the *Septum*, towards the Cone of the Heart, whence the *Columnæ Carneæ* take their Rise.

CC The external Surface of the Mitral Valve, to which the Tendons deriv'd from the *Columnæ Carneæ* are variously inserted.

DD Divers Tendons springing in like manner from the *Columnæ Carneæ*, cut from the Sides of the Ventricle.

b A transverse Tendon between the *Columnæ Carneæ*.

i The opposite part of the Mitral Valve, express'd at C, Fig. II. next the Orifice of the *Aorta*.



TAB. XL.

FIG. I.

The Left Ventricle of the Heart opened, together with the Vena Pulmonalis and Trunk of the Aorta, to shew in one View the Position of the Valves, that hinder the Return of the Blood by the same way it came into the Ventricle, as well as those Valves, that prevent the return of the Blood, after it is expell'd from thence by the Systole of the Heart.

AA The Sides of the Heart divided, from its Basis, where the *Aorta* and *Vena Pulmonalis* pass by each other, to

B The Cone of the Heart.

C, C, D The large bulbous Trunk of the *Vena Pulmonalis*, open'd and pinn'd out.

E The Orifice, that leads into the Left Auricle.

F The external Surface of the Left Auricle of the Heart.

GG A Probe supporting the Mitral Valve, whereby the Tendons springing from the *Carnea Columnæ* are made very conspicuous, and the use of the Position of those Organs, mention'd in the Explication of Fig. II. of the preceding Table, farther illustrated.

gg The divided Sides of the Mitral Valve.

bb Divers transverse tendinous and fleshy Fibres, appearing in this Position, in the Left Ventricle of the Heart.

I The internal Surface of the Left Ventricle, leading to the *Aorta*, which is smooth, for the more easy Ascent of the Blood that way to the *Aorta*.

KK The *Aorta* cut off and expanded.

L An Ear Scoop, supporting one of the Semilunar Valves of the *Aorta*.

l, l The other two Semilunar Valves, as they appear in this Position.

M The Trunk of the *Arteria Pulmonalis*, cut off.

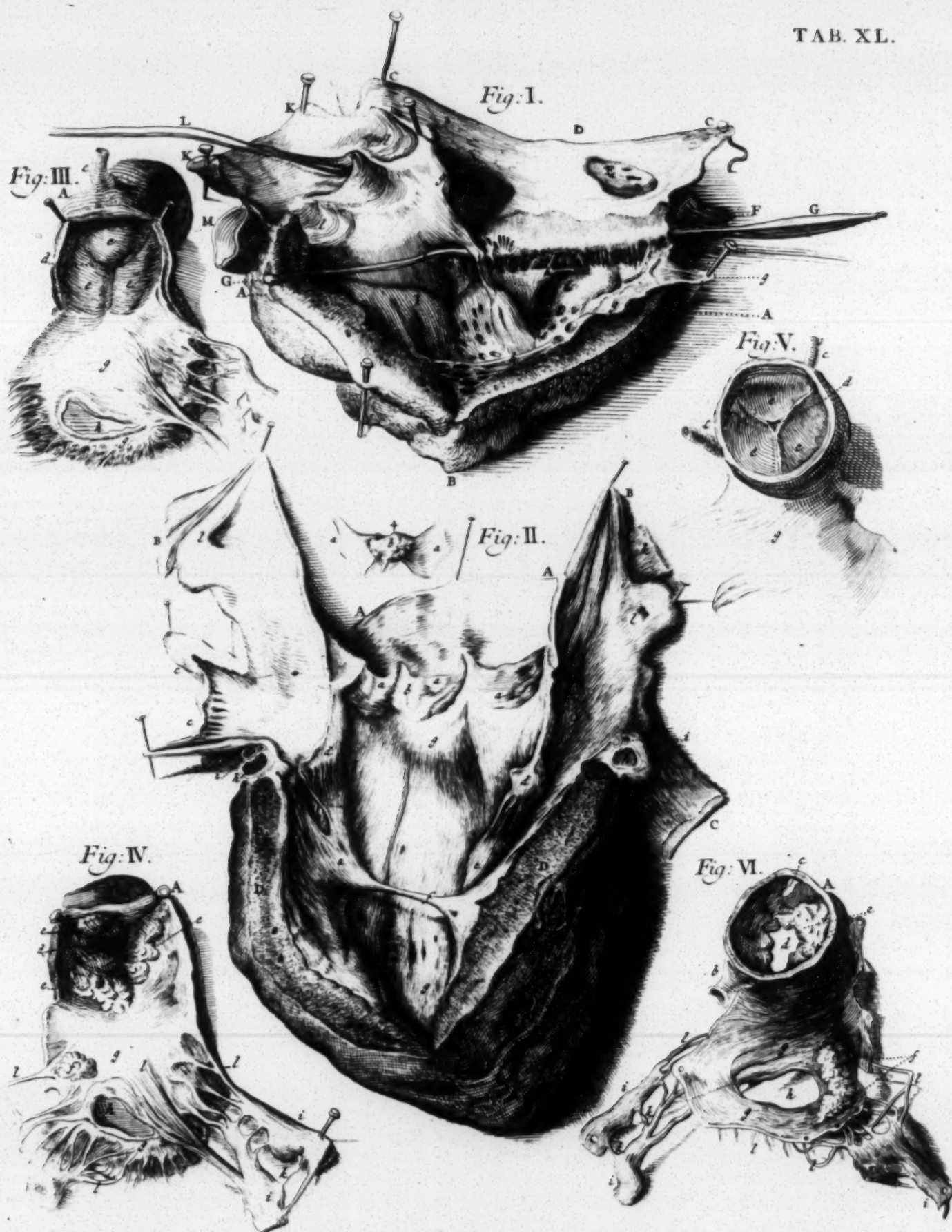
FIG. II.

Is drawn from the same Heart express'd Fig. I. in the preceding Table, after dividing the Vena Pulmonalis, through the middle, (as 'tis there represented) together with the Arteria Aorta.

AA The *Aorta* cut off near the Basis of the Heart, and slit open and display'd.

B, B The bulbous Trunk of the *Vena Pulmonalis* divided through, with part of the *Aorta* annex'd to it, and pinn'd aside, to shew

aaa The



aaa The three Semilunar Valves of the *Aorta*, which prevent the return of the Blood from thence, after its Expulsion from the Left Ventricle, *gg*, by the *Systole*, or Contraction of the Heart.

b A Petrefaction, that grew at the Conjunction of these two Valves in this Subject, whereby they were thickned and incommoded in the due Execution of their Office; whence it happened (some time before the Death of the Person to whom this Heart belong'd) that the *Systole* was interrupted, as appear'd by the Inequalities of his Pulse, sometimes missing one Stroke in ten; but when the Blood happen'd to be any ways quicken'd in its Motion, whether by any agitation of Body or Mind, these Interruptions became more frequent, especially near the latter end of his Life, which was before he arriv'd to the Age of thirty three Years. This Petrefaction not appearing to view so plain, as when the Parts about it were dried, it is therefore express'd at †, where the same Letters are placed on it and Parts of the two Valves annex'd, as in the great Figure. See *Philos. Transactions*, No 299. p. 1970, &c.

C Part of the lower Trunk of the *Vena Cava*, cut off immediately above the Liver.

cc The Left Auricle of the Heart open'd from the *Vena Pulmonalis*, and pinn'd out.

DD The Sides of the Left Ventricle divided and drawn aside, to shew its Cavity at *dd*, *ee*, *f*, *g*.

dd Part of the Mitral Valve, divided and drawn to each Side.

ee The *Columnæ Carneæ*.

f The Transverse Chord mention'd at *h*, in Fig. 1. of the preceding Table.

gg The internal smooth Surface of the Left Ventricle near the Orifice of the *Aorta*.

h The Coronary Vein, and

i The Coronary Artery divided.

k One of the Branches of the *Vena Pulmonalis*.

ll Orifices of other Branches, as they appear opening into the bulbous Trunk of that Vein.

FIG. III.

Part of the *Aorta* cut off next the Basis of the Heart, to shew its Valves, as they appear next the Ventricle, when the Heart is in Diastole, and the Blood hinder'd by them in its return from the *Aorta* to the Left Ventricle, after its Expulsion from thence.

A Part of the *Aorta* cut off immediately above the Basis of the Heart.

c Part of one of the Coronary Arteries.

d The meeting of the middle Parts of the three Valves in the Center of the Orifice of the *Aorta*.

eee The three Semilunar Valves, as they appear, when the Blood in the great Artery presses them together, whereby they hinder its return into the Left Ventricle.

U u

gg Part

EXPLANATION of the TABLES.

g g Part of the Mitral Valve.
b Its Orifice, by which the Blood flows from the *Vena Pulmonalis* into the Left Ventricle of the Heart.

FIG. IV.

A Portion of the Aorta, with the Parts annex'd, in the same Position, as was represented in the preceding Figure, taken from a morbid Body, in which the use of the Semilunar Valves was entirely defeated by a large Petrefaction, that grew upon them.

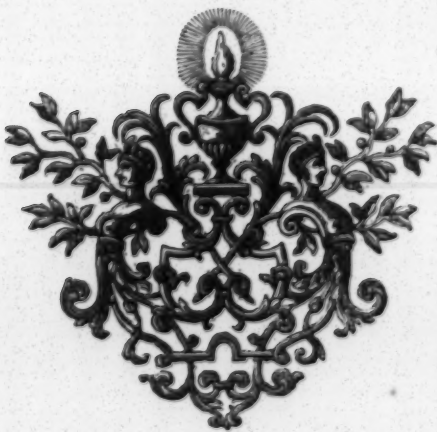
A The Trunk of the Aorta, cut from the Basis of the Heart.
d A large triangular Aperture, which always remain'd open by reason of
e, e, e The Petrefaction of the three Semilunar Valves.
f A Petrefaction of the *Valvula Mitralis*.
g, g The Mitral Valve, which was very much stiffned in this Subject.
b Its Orifice, as above-mention'd.
i, i, i Carnons Columns taken out and display'd, to shew the Tendons arising from them, and terminating variously, as express'd at *l, l*, on the Mitral Valve.
k k Divers transverse Tendons, that help to approach the fleshy Columns to each other in the *Systole*.

FIG. V. VI.

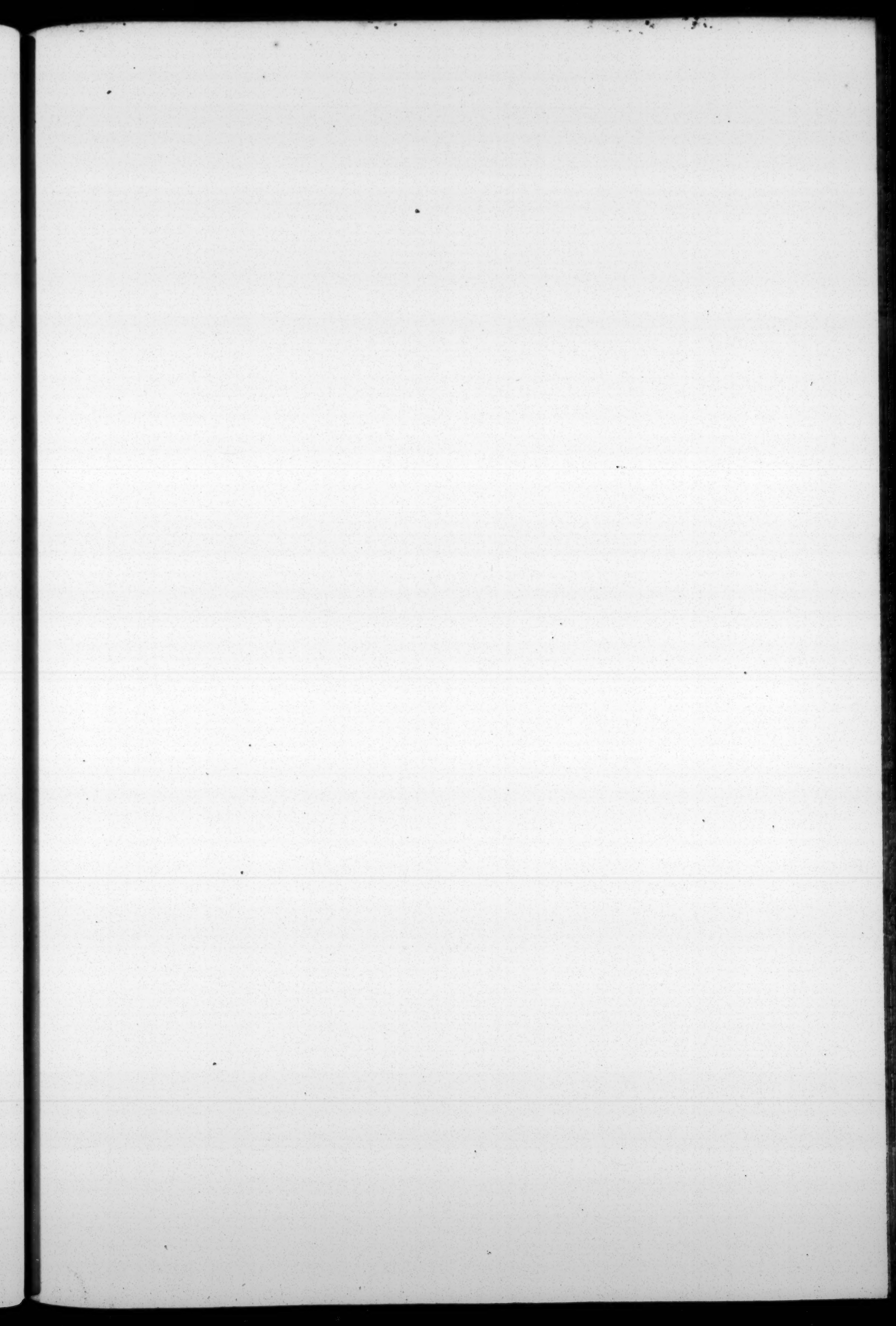
Shew the same Parts of the Aorta, with its Valves viewed from the great Artery towards the Heart.

N. B. The same Letters of Reference, with those of the two preceding Figures, serve to both, except Fig. vi.

b The Trunk of one of the Coronary Arteries.
c The Aperture of the other Coronary Artery, the Trunk of which happen'd to be cut off in the Dissection from the Heart.

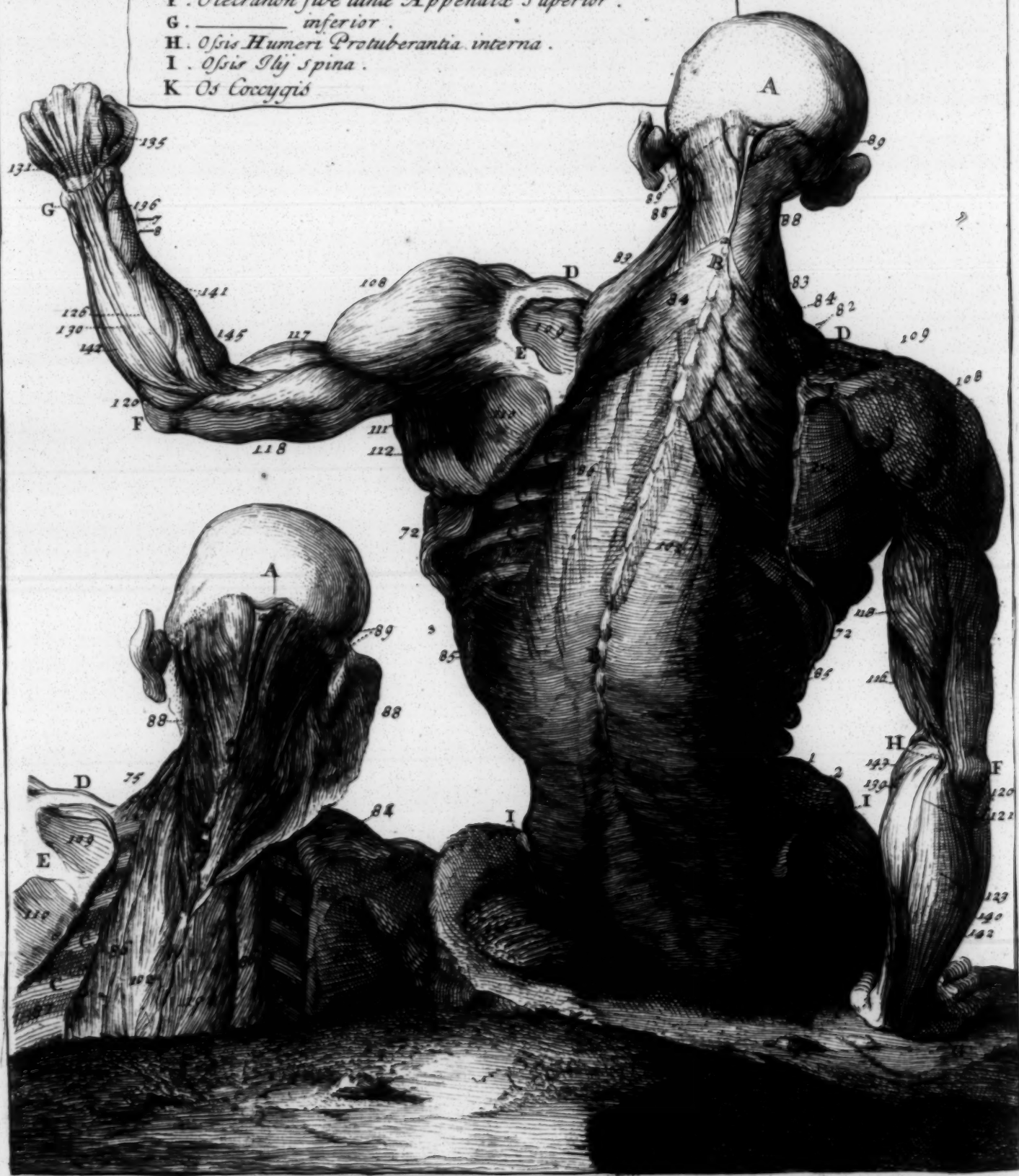


TAB.



A. Os Occipitale
 aa. Ligamentum Colli.
 B. Vertebrarum Dorsi Spina.
 C. 8^a Costa.
 D. Clavicula.
 E. Spina Scapulae.
 e. ejus Basis.
 F. Olecranon sive Ulna Appendix superior.
 G. inferior.
 H. Os Humeri Protuberantia interna.
 I. Os Ilii Spina.
 K. Os Coccygis

TAB. XLI.



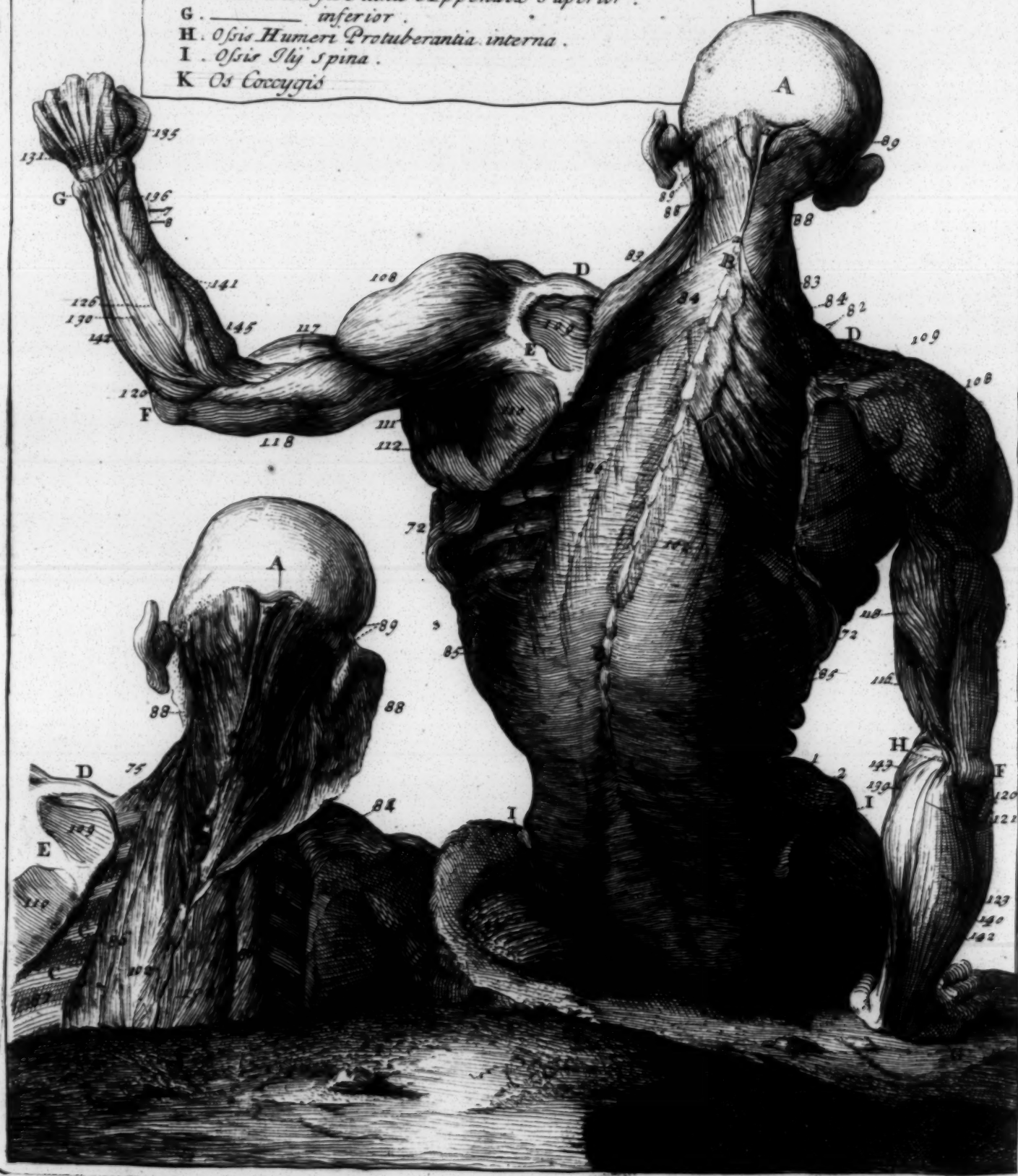
TAB. XLI.

The Parts here represented, being sufficiently explain'd by the References engrav'd on the Plate, and the general Table of the Muscles, we shall add no other Description.



A. Os Occipitale
 a a. Ligamentum Colli.
 B. Vertebrae Dorsi Spina.
 C. 8^a Costae.
 D. Clavicula.
 E. Spina Scapulae.
 e. ejus Basis.
 F. Olecranon sive Ulna Appendix Superior.
 G. ————— inferior.
 H. Os Humeri Protuberantia interna.
 I. Os Ilii Spina.
 K. Os Coccygis.

TAB. XLI.



TAB. XLI.

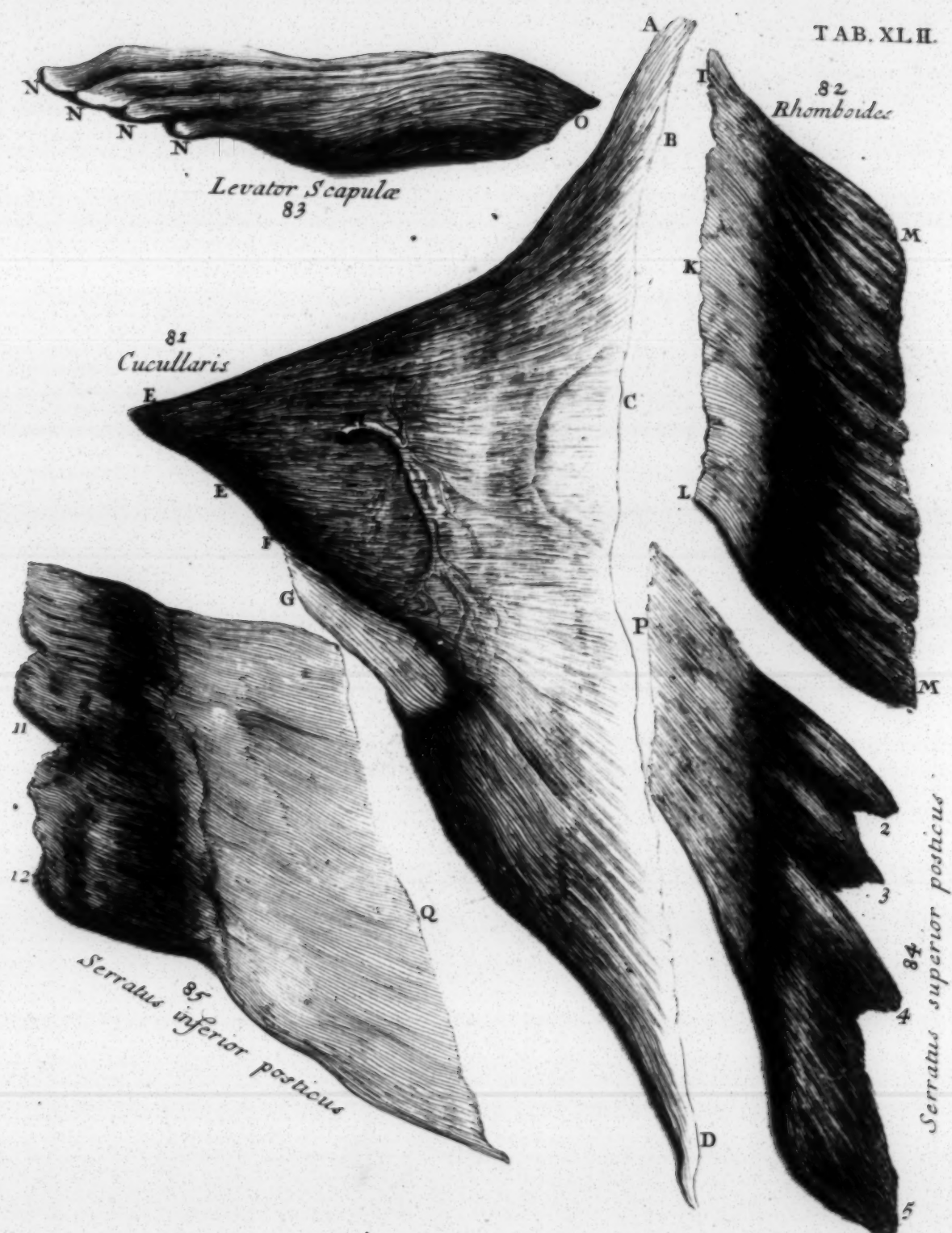
The Parts here represented, being sufficiently explain'd by the References engrav'd on the Plate, and the general Table of the Muscles, we shall add no other Description.

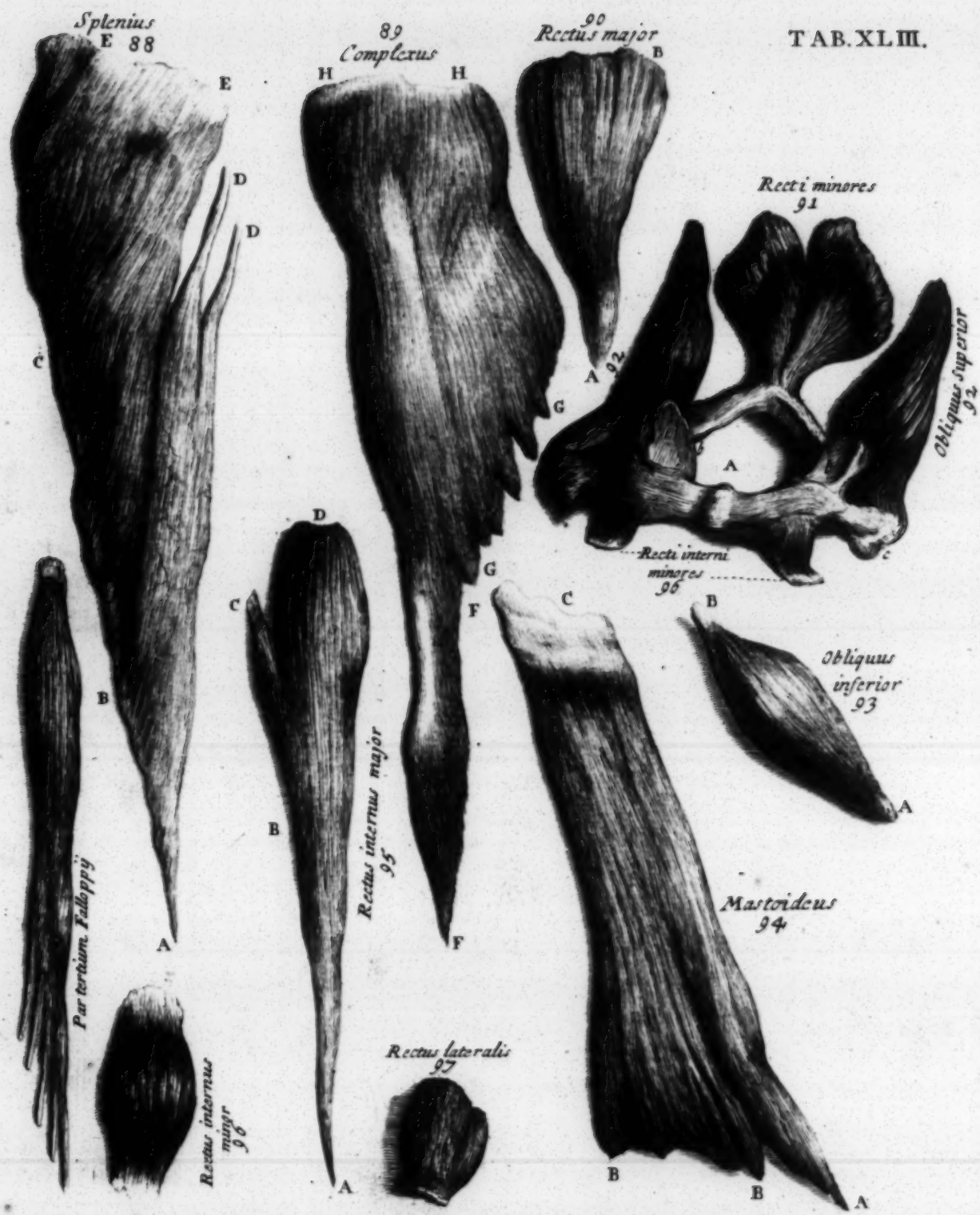


TAB. XLII.

- 81 The Inside of the *Cucullaris*, of the right Side.
 A That part of it, that springs from the *Occiput*,
 B From the *Ligamentum Colli*,
 CD From the eight superiour Spines of the *Vertebrae* of the *Thorax*.
 EE Its fleshy Termination cut from the *Clavicula*.
 FG Its fleshy and tendinous ending in the Spine of the *Scapula*.
 H The Trunks of its Blood Vessels.
 82 The internal Surface of the *Rhomboides*, of the left Side.
 IK Its tendinous Origine, from the *Ligamentum Colli*, and the Spine of the lowermost *Vertebra* of the Neck.
 KL From the four superiour Spines of the *Vertebrae* of the *Thorax*.
 MM Its fleshy Termination, cut from the *Basis Scapulae*.
 83 The *Levator Scapulae*, of the right Side.
 NNNN Its four partly tendinous, and partly fleshy Originations, cut from the transverse Processes of the first, second, third and fourth *Vertebrae* of the Neck.
 O Its Ending, cut from the superiour Angle, and part of the *Basis*, of the *Scapula*.
 84 The internal Surface of the *Serratus Superior Posterior*, of the left Side.
 P Its tendinous Origine, cut from the Spines of the *Vertebrae* of the Neck and *Thorax*.
 2, 3, 4, 5 Its fleshy Terminations on the second, third, fourth, and fifth Ribs.
 85 The external Surface of the *Serratus Inferior Posterior*, of the left Side.
 Q Its tendinous Part, freed from the Spines of the *Vertebrae* of the *Thorax* and *Loins*, as well as from the *Dorsi Latissimus*, to which it firmly adheres.
 11, 12 Its fleshy Terminations, freed from the lower Ribs.







TAB. XLIII.

88 The external Surface of the *Splenius*, of the right Side.

AB Its lower part, which appears distinct in some Subjects, and may be truly reckon'd a Muscle of the Neck, arising from the Spines of the *Vertebrae* of the *Thorax*.

BC That part of this Muscle, that springs from the Spines of the *Vertebrae* of the Neck.

DD The two Tendons of its lower part, which terminate in the transverse Processes of the first and second *Vertebrae* of the Neck.

EE Cut from its Implantation on the *Occiput*.

89 The exterior Face of the *Complexus* of the same Side.

FF Springs from the six superiour transverse Processes of the *Vertebrae* of the *Thorax*.

GG Are its partly tendinous and partly fleshy Originations, from the six inferior transverse Processes of the *Vertebrae* of the Neck.

HH That part, which terminates on the *Os Occipitis*.

90 The *Rectus Major*, of the right Side.

A Its narrow Original, cut from one part of the double Spine of the second *Vertebra* of the Neck.

B Its broad end, implanted on the *Os Occipitis*.

91 The *Recti Minores*, cut from their Insertions at the *Occiput*, and left at their Origine, at the back part of the first *Vertebra* of the Neck.

A The first *Vertebra* of the Neck.

bb Its two Processes, that are articulated with those of the *Occiput*.

cc Its transverse Processes, whence the *Recti Laterales* arise.

92 The *Obliquus Superior*, cut from the *Occiput*, and left at its Origine from the back part of the transverse Process of the first *Vertebra* of the Neck.

93 The *Obliquus Inferior*.

A Its Origine, from the Spine of the second *Vertebra* of the Neck.

B Its Termination, at the transverse Process of the first *Vertebra*.

94 The outside of the right *Mastoideus*.

A That part of it that springs tendinous from the *Sternum*.

BB From the *Clavicula*.

C Its broad tendinous Ending, cut from the back part of the *Processus Mammillaris*, and the adjoining part of the *Os Occipitis*.

95 The external Surface of the *Rectus Internus Major*, of the left Side.

AB That part of it which arises from the *Vertebrae* of the Neck.

C A part of this Muscle, that in this Subject was inserted into the transverse Process of the first *Vertebra* of the Neck.

D That part of it, that was cut from the anterior *Appendix* of the *Os Occipitis*.

96 The *Rectus Internus Minor*.

97 The *Rectus Lateralis*.

TAB. XLIV.

FIG. I.

The back Parts of the Vertebrae of the Neck, as they appear'd in a late Subject, with the Muscles and Parts annex'd, as big as the Life.

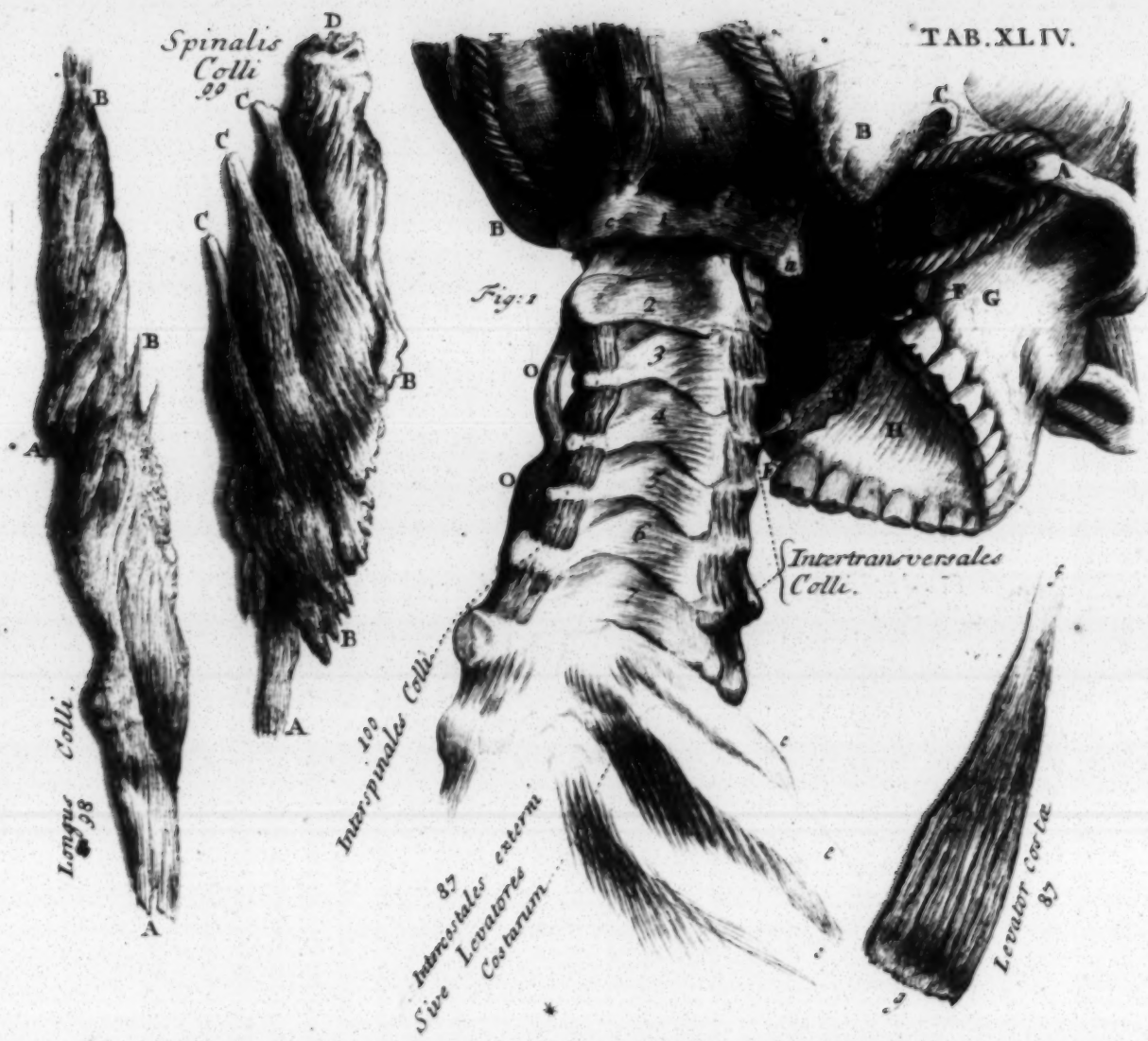
- A The *Os Jugale*.
- B The *Processus Mastoideus*.
- C The *Meatus Auditorius*, as it appears, after the *Auricula* is cut off.
- D The shallow Cavity, that receives the Head of the *Processus Condylodes* of the lower Jaw-bone.
- E The external Surface of the *Ala Vespertilionis* of the *Os Sphenoides*, where the *Musculus Pterygoideus Internus* does arise.
- F The *Processus Pterygoideus*, on which the Tendon of the *Pterygostaphylinus* passes.
- G The fourth Bone of the upper Jaw, where it makes the external *Paries* of the *Antrum Maxillae Superioris*.
- H That part of the same Bone, which makes the roof of the Mouth, here cover'd with the glandulous Membrane of the Palate.
- I The Glands, as they appear'd, where the *Uvula* was cut off.
- K The *Septum Narium*, towards the *Fauces*.
- L The *Os Occipitale*.
- 91 M The *Recti Minores*.
- N The *Rectus Lateralis*.
- † The *Processus Styloides*.
- OO A round, slender, and long Muscle, which I found in this Subject, arising from the Spinal Process of the sixth *Vertebra*, and ending in that of the second *Vertebra* of the Neck; but this I have observ'd is wanting in most Subjects.
- 1, 2, 3, 4, 5, 6, 7 The back Parts of all the *Vertebrae* of the Neck.
- a The transverse Process of the first *Vertebra* of the Neck.
- b A rising in the back Part of this *Vertebra*, which makes the *Sinus*, that receives the oblong Process of the *Os Occipitale* on that side.
- c The back Part of this *Vertebra*, without any Spinal Process.
- d A strong, large, but loose Ligament, between the first and second *Vertebra* of the Neck, so framed to give way to the Motion of the first *Vertebra*, in turning the Head to either Side.
- e, e, e The three upper Ribs.
- 87 The external Intercostal Muscles, as they appear near the *Vertebrae* of the *Thorax*, where they arise from the transverse Processes of the *Vertebrae*, and descend obliquely to the upper Part or Margin of each Rib. These Parts of the Intercostal Muscles have by some been reckon'd distinct Muscles; but, if you consider,

TAB. XLIV.

FIG. I.

The back Parts of the Vertebrae of the Neck, as they appear'd in a late Subject, with the Muscles and Parts annex'd, as big as the Life.

- A The *Os Jugale*.
 B The *Processus Mastoideus*.
 C The *Meatus Auditorius*, as it appears, after the *Auricula* is cut off.
 D The shallow Cavity, that receives the Head of the *Processus Condylodes* of the lower Jaw-bone.
 E The external Surface of the *Ala Vespertilionis* of the *Os Sphenoides*, where the *Musculus Pterygoideus Internus* does arise.
 F The *Processus Pterygoideus*, on which the Tendon of the *Pterygostaphylinus* passes.
 G The fourth Bone of the upper Jaw, where it makes the external *Paries* of the *Antrum Maxillae Superioris*.
 H That part of the same Bone, which makes the roof of the Mouth, here cover'd with the glandulous Membrane of the Palate.
 I The Glands, as they appear'd, where the *Uvula* was cut off.
 K The *Septum Narium*, towards the *Fauces*.
 L The *Os Occipitale*.
 M The *Recti Minores*.
 N The *Rectus Lateralis*.
 † The *Processus Styloides*.
 OO A round, slender, and long Muscle, which I found in this Subject, arising from the Spinal Process of the sixth *Vertebra*, and ending in that of the second *Vertebra* of the Neck; but this I have observ'd is wanting in most Subjects.
 1, 2, 3, 4, 5, 6, 7 The back Parts of all the *Vertebrae* of the Neck.
 a The transverse Process of the first *Vertebra* of the Neck.
 b A rising in the back Part of this *Vertebra*, which makes the *Sinus*, that receives the oblong Process of the *Os Occipitale* on that side.
 c The back Part of this *Vertebra*, without any Spinal Process.
 d A strong, large, but loose Ligament, between the first and second *Vertebra* of the Neck, so framed to give way to the Motion of the first *Vertebra*, in turning the Head to either Side.
 e, e, e The three upper Ribs.
 87 The external Intercostal Muscles, as they appear near the *Vertebrae* of the *Thorax*, where they arise from the transverse Processes of the *Vertebrae*, and descend obliquely to the upper Part or Margin of each Rib. These Parts of the Intercostal Muscles have by some been reckon'd distinct Muscles; but, if you consider,



der, that the *Intercostales Externi* have the same Direction of Fibres with these, and that they are in most Places inseparably intermix'd with each other, there appears no reason to multiply the Names of Muscles in making these distinct, tho' for the better Explication of the Use of that Part, which arises from the transverse Process of the *Vertebra*, f, and is implanted in the Rib g, I have inscrib'd it with the Name of *Levator Costæ*, on the Copper Plate.

98 The Inside of the *Longus Colli*, of the left Side, as big as the Life.

AA The lower tendinous Part, that springs from the three superiour *Vertebrae* of the *Thorax*, and three lowermost of the Neck.

BB Its tendinous Terminations, cut from the four upper *Vertebrae* of the Neck.

99 The internal Surface of the *Spinalis Colli*, of the left Side, as big as the Life.

ABB Its partly tendinous and partly fleshy Originations from the five superiour transverse Processes of the *Vertebrae* of the *Thorax*, and inferiour one of the Neck.

C, C, C Three of its Tendons, which terminated in the third, fourth and fifth double Spines of the *Vertebrae* of the Neck.

D Its largest Termination, freed from the inferiour part of the second *Vertebra* of the Neck laterally.

100 The *Interspinales Colli*, as they appear between all the double Spines of the *Vertebrae* of the Neck.

103 The internal Surface of the *Quadratus Lumborum* of the right Side, as big as the Life.

A Its fleshy Original, from the back part of the Spine of the *Os Ilium*, next the *Os Sacrum*.

BBB Its Terminations, freed from the *Vertebrae* of the Loins, and lower Edges of the two inferiour Ribs.



TAB. XLV.

FIG. I. II.

The exterior and interior Surfaces of the Longissimus Dorfi, Sacrolumbalis, Sacer, Semi-Spinatus, and Transversalis Colli, dissected from an emaciated Body.

A The Origine of the *Sacrolumbalis*, and *Dorfi Longissimus*, in common, from the upper part of the *Os Sacrum*, and back part of the Spine of the *Os Ilium*, a a.

b, b, b Divers Terminations of them, on the transverse Processes of the *Vertebrae* of the Loins.

B, B Their tendinous outside, on the Region of the Loins, from which the Tendons of the *Dorfi Latissimus*, and *Serratus Inferior Posticus*, may be easily separated.

C, C, C Some Tendons of the *Longissimus Dorfi*, that terminate on the back part of the Ribs.

D, D Two tendinous Slips, springing from the *Longissimus Dorfi*, which terminate on the transverse Process of the first *Vertebra* of the *Thorax*.

E That part of it, that was inserted into the lower transverse Processes of the *Vertebrae* of the Neck.

F Another Production of this Muscle, which, with its Partner on the other Side, is by *Falloppius* called *Par tertium Capitis*, and is implanted on the *Os Occipitis*, behind the *Processus Mastoideus*.

G, G, G The external Parts of the *Sacrolumbalis*, with its tendinous Productions, arising fleshy from the lower Ribs **, and ascending obliquely to their Terminations on the upper Ribs.

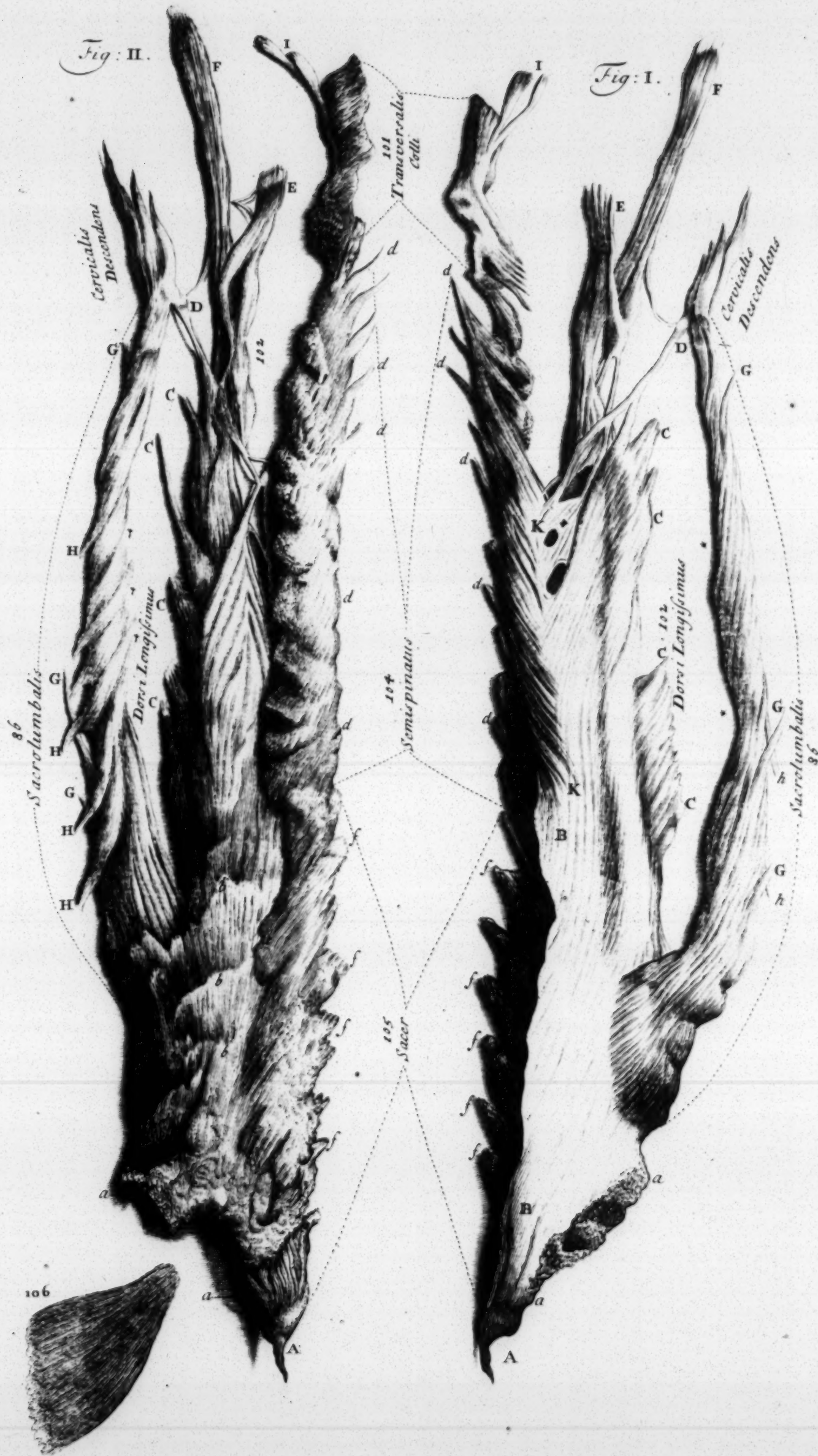
H, H, H, b, b Two or three, of many other Productions of this Muscle, which, also springing from the lower Ribs, ascend obliquely upwards and inwards, decussating the former at acute Angles, as they pass to their Terminations on the superior Ribs. *Vid.* Fig. II. †††.

101 The exterior and interior Surfaces of the *Transversalis Colli*, continued with the upper part of the *Semispinatus*.

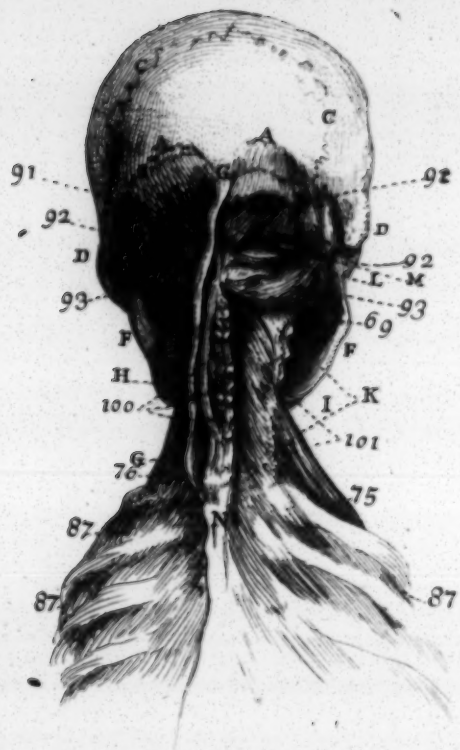
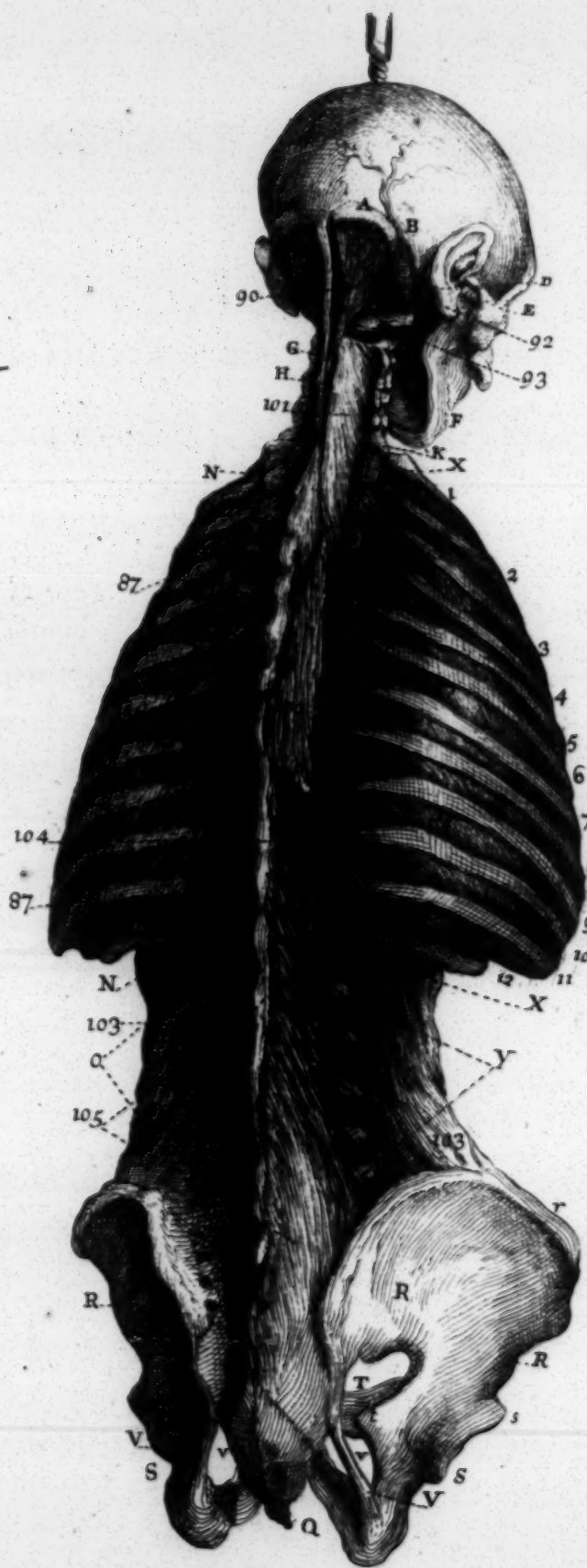
I Two Productions of this Muscle, the slenderest and longest of which is implanted on the *Occiput*, with the Production of the *Dorfi Longissimus*, at F. The other short one is also inserted into the *Os Occipitale*, near the *Mastoide Process*.

102 The Body of the *Dorfi Longissimus*.

K, K Some fleshy Fibres, springing from the tendinous outside of the *Longissimus Dorfi*, which ascending obliquely join with those that lie underneath, and spring from the *Vertebrae Dorfi*, express'd at c, c, c, Fig. II. and are afterwards inserted into the Spines of the *Vertebrae*, d d d, which makes up



TAB. XLVI.

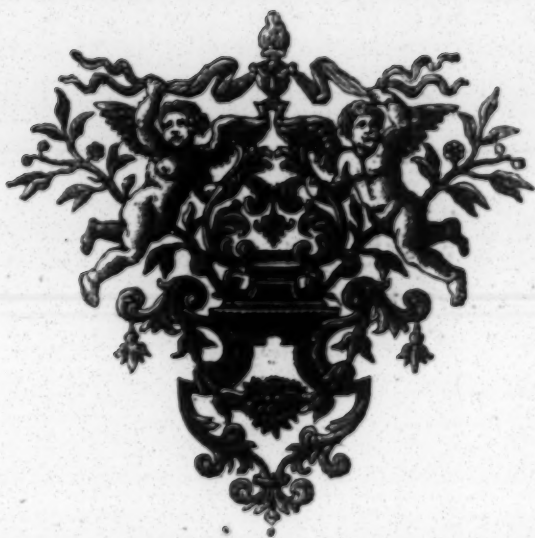


- A. Os Occipitis.
 B. Vasa Sanguinea.
 C. Sutura Lambdoides.
 D. Processus Mammiformis.
 E. Os Jugale.
 F. Maxilla inferior.
 G. Ligamentum Occipitale.
 H. Musculus Superspinalis Colli.
 I. Vertebrae Colli Spinae bifidae.
 K. Processus transversales earundem.
 L. Prima Vertebra colli pars posterior.
 M. Arteria Vertebralis Truncus.
 N. Vertebrae Dorsi Spinae.
 O. ———— Lumborum.
 P. ———— Os Sacri.
 Q. Os Coccygis.
 R. Os Ilium: r. ejus Spina
 S. Os Ischium
 s. Supercilium acetabuli
 t. Ischij Processus Acutus
 T. Os Pubis
 v. Foramen ejus
 V. Ligamentum quod Tuberculum Ischij
 cum Os Sacro conjungit
 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. Costa duodecim.
 X. Vertebrae Thoracis Processus Transversi
 Y. ———— Lumborum Processus Transversi
 102 Dorsi Longissimi pars

EXPLANATION *of the* TABLES.

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- 104 The external and internal Surfaces of the *Semispinatus*.
105 The external and internal Surfaces of the *Sacer*.
eee Those Parts of it that spring from the *Vertebrae* of the Loins, which ascend obliquely, and compose
fff Divers Digitations, that terminate in the Spines of the *Vertebrae* of the Loins.



TAB. XLVI.

Is sufficiently explain'd by the References engrav'd on the Plate.



TAB. XLVII.

107 The internal Surface of the *Pectoralis*, of the right Side.

A B Its fleshy Origination. Here it may be observ'd, that the Fibres of the lower Part, B, ascend and decussate those of its upper Part, A, in its broad Tendon, C, inferted into the *Os Humeri*.

D A Production of the Tendon of the *Pectoralis*, which ascends and joins the Ligament of the Articulation of the *Os Humeri* with the *Scapula*.

108 The internal Surface of the *Deltoides*, of the right Side.

BC Its tendinous Origine from the *Spina Scapulae*.

A Its fleshy one from the *Clavicula*.

D Part of the *Periosteum*, into which it is inferted on the *Os Humeri*.

109 The internal Surface of the *Supraspinatus*.

AA Its fleshy Original from the *Scapula*.

B Its tendinous Termination on the *Os Humeri*.

110 The Inside of the *Infraspinatus*.

AA Its fleshy Original from the *Scapula*.

B Its tendinous Termination on the *Os Humeri*.

CC Its Arteries fill'd with Wax.

111 The outside of the *Rotundus Minor*.

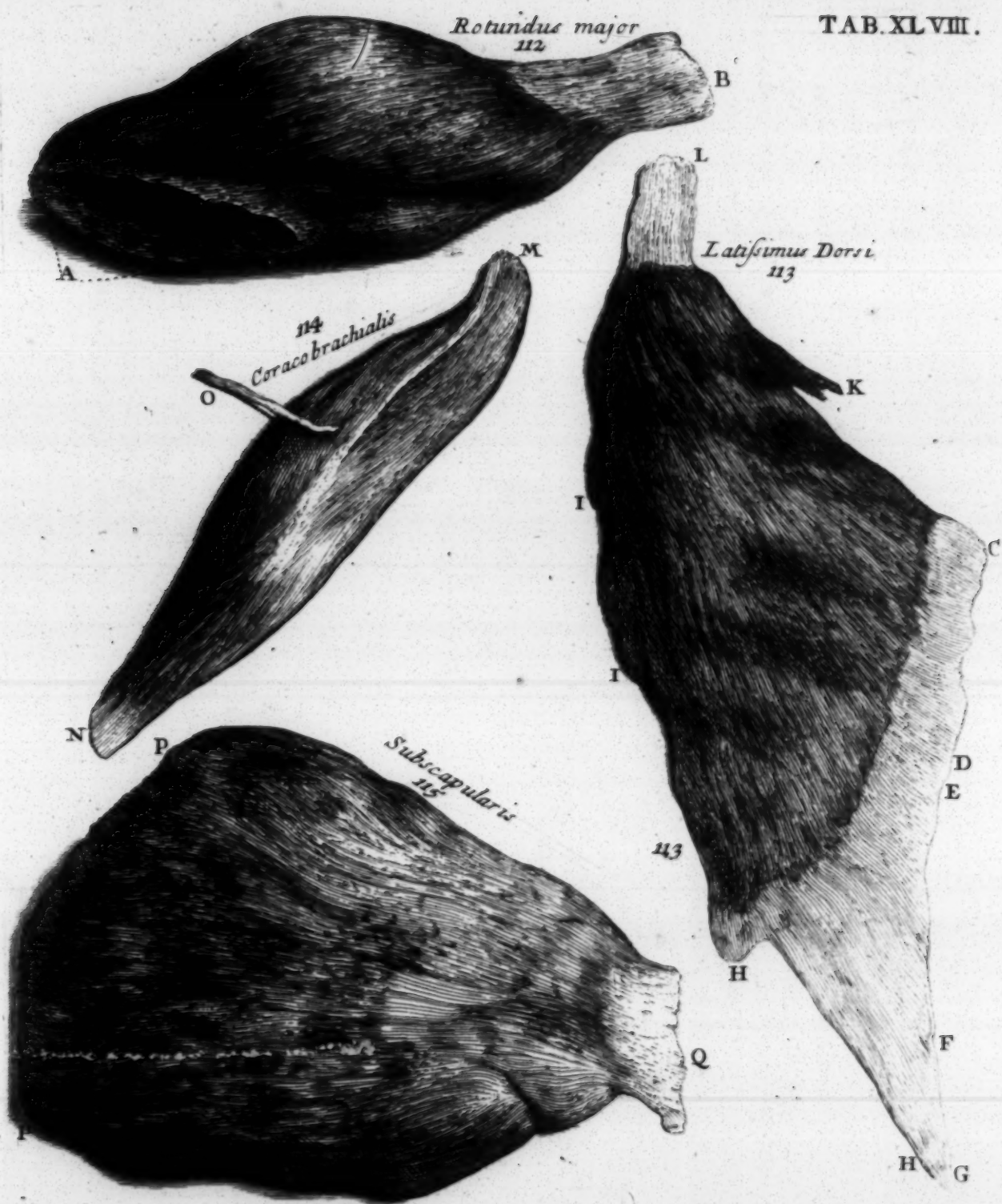
A Its Original from the *Scapula*.

B Its Termination on the *Os Humeri*.

The lower Figure in this Table shews the Disposition of the Fibres, as they appear, when the *Infraspinatus* is divided according to its Length, very much resembling the Plume of a third or fourth Goose-Quill.



TAB. XLVIII.



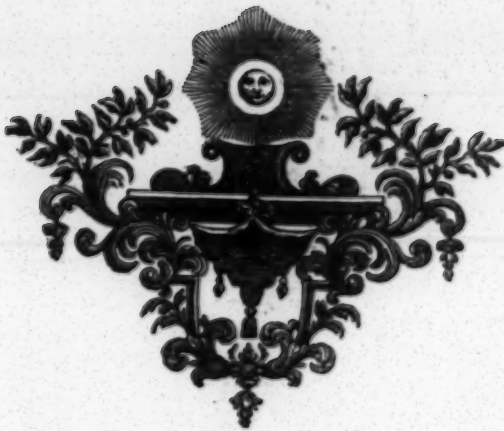
TAB. XLVIII.

- 112 The Inside of the *Rotundus Major*.
 A Its fleshy Original.
 B Its tendinous Termination.
 113 The internal Surface of the *Latissimus Dorsi* of the right Side.
 CD Its tendinous Origination from the seven inferiour Spines of the *Vertebræ* of the *Thorax*.
 EF From those of the Loins.
 G From the Spines of the *Os Sacrum*.
 HH From the Spine of the *Os Ilium*.
 II Its *Fasciculi* of fleshy Fibres from the Ribs.
 K Others from the *Scapula*.
 L Its Tendon, at its Insertion into the *Os Humeri*.
 114 The Inside of the *Coracobrachialis*, as big as the Life.
 M Its Origination from the Extremity of the *Processus Coracoides Scapulae*.
 N Its tendinous Insertion into the middle of the internal Part of the *Os Humeri*.
 O The Trunk of the Nerve, that passes through this Muscle.
 115 The internal Surface of the *Subscapularis*.
 PP Its fleshy Origination, freed from the internal concave Part of the *Scapula*.
 Q Its Tendon, cut from the *Os Humeri*.

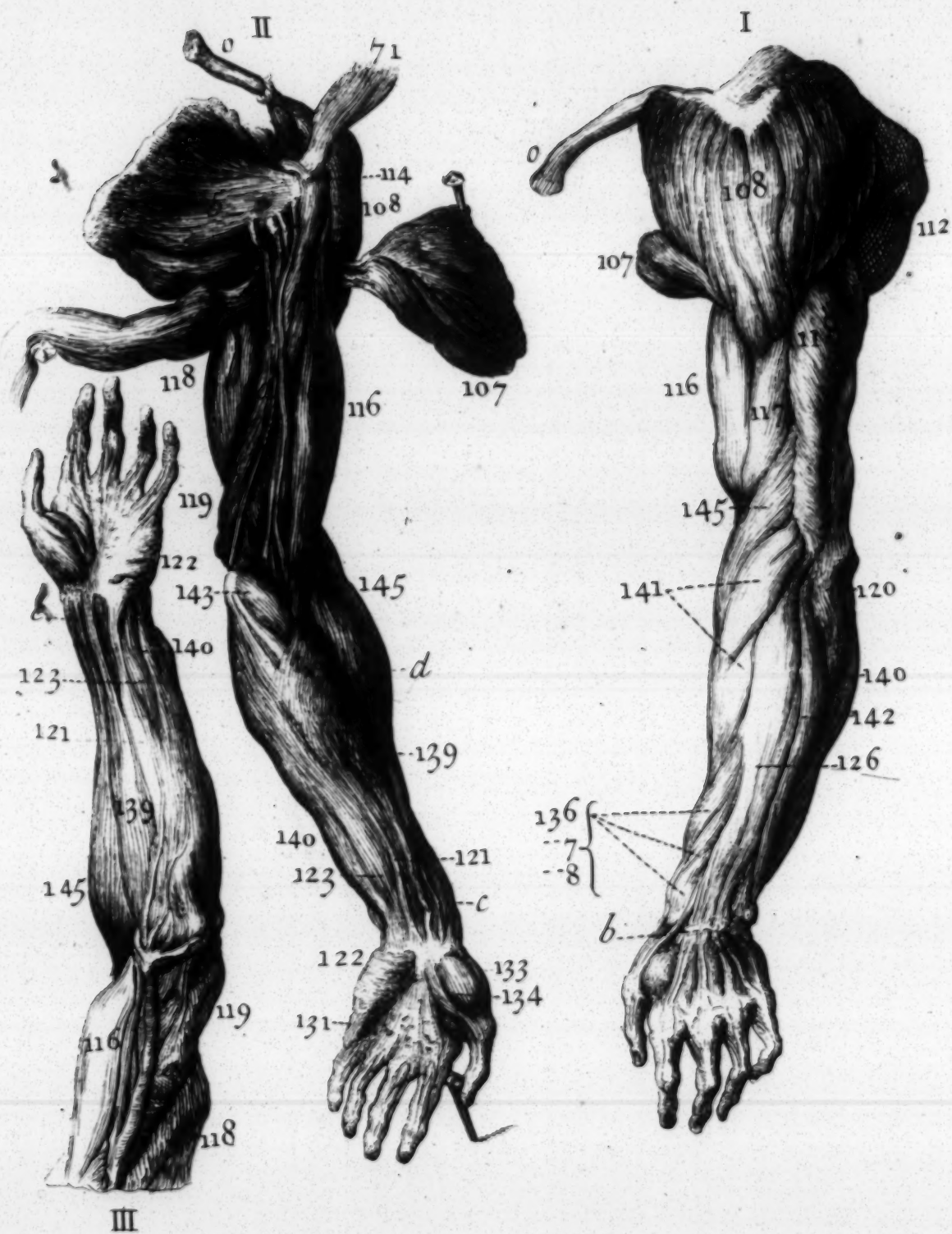


TAB. XLIX.

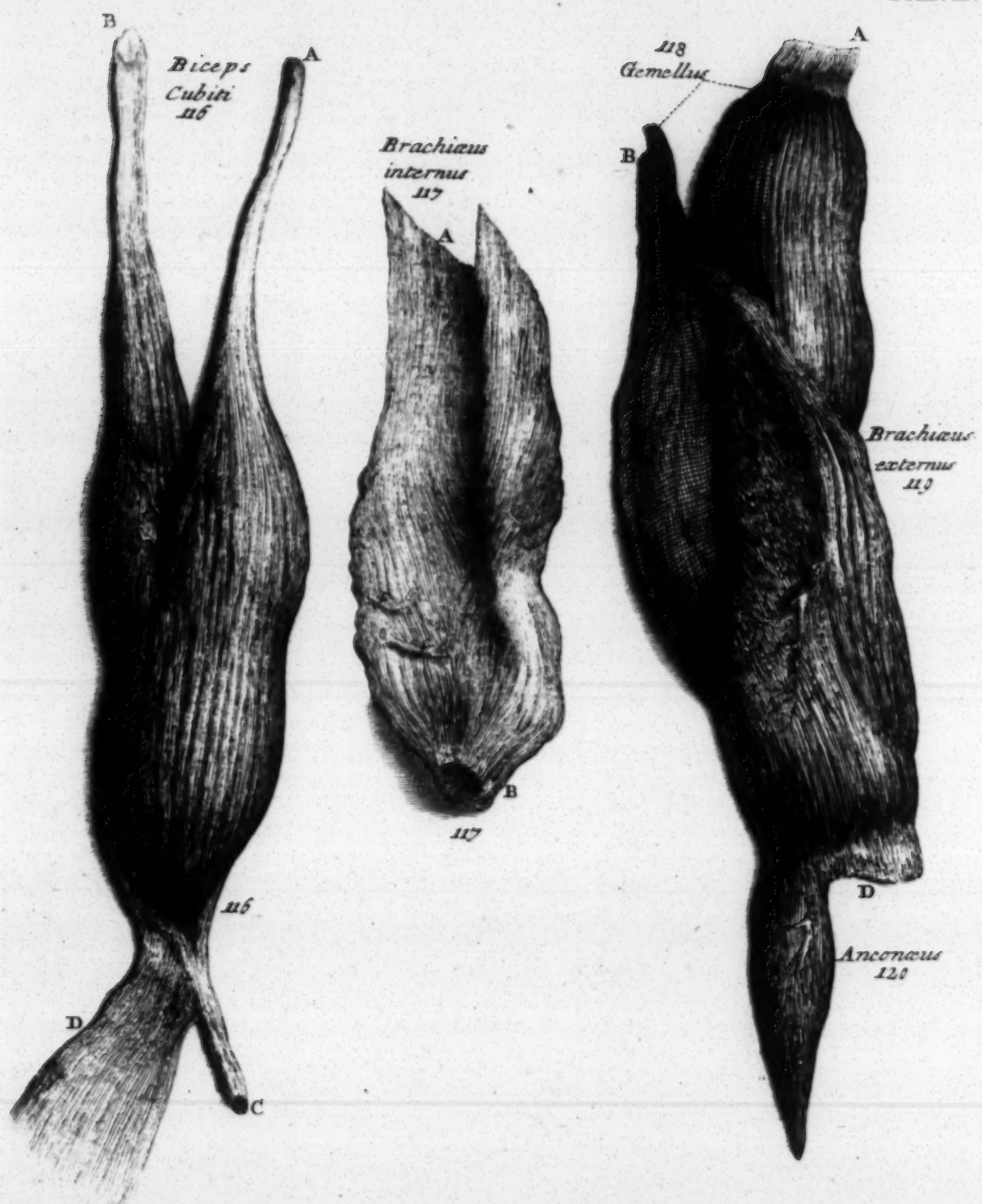
- O The *Clavicula*.
- a The Blood Vessels and Nerves of the Arm.
- b The annular Ligament of the *Carpus*.
- c The superiour Branch of the Artery, passing between the Tendons of the *Supinator Radii Longus*, and *Flexor Carpi Radialis*, which makes the Pulse in the Wrist.
- d The tendinous Expansion of the *Biceps*.



TAB. XLIX.



TAB. L.



TAB. L.

116 The inside of the *Biceps Cubiti* of the right Arm.

A Its external Head, which is a round Tendon springing from the upper part of the *Acetabulum Scapulae*.

B The internal Head, or beginning, of the *Biceps*, freed from the *Processus Coracoides Scapulae* and the *Musculus Coracobrachialis*, to which it adheres.

C The Tendon of the *Biceps*, cut from the Tubercle near the upper end of the *Radius*.

D An other membranous Tendon of this Muscle, that is expanded with the *Membrana Communis Musculorum*, and strictly embraces all the external Muscles of the *Carpus* and Fingers, therefore call'd *Fascia Tendinosa*.

f The Blood Vessels on its inside.

117 The inside of the *Brachialis Internus* of the right Arm.

A Its internal concave Surface, as it arises from the *Os Humeri*.

B Its lower part, cut from its Insertion into the fore part of the *Ulna*.

ff Some Blood Vessels, creeping on the inside of this Muscle next the Bone.

118 The inside of the *Gemellus* of the right Arm, together with

119 The *Brachialis Externus*.

120 The *Anconeus*.

A The first Head or Beginning of the *Gemellus*, which springs with a tendinous Origine from the inferiour *Costa* of the *Scapula*.

B The second Head of the same Muscle, from the upper and back part of the *Os Humeri*.

C The internal concave Surface of the *Brachialis Externus*, where it sprang from the *Os Humeri*, with the Arteries, f, as they appear'd fill'd with Wax.

D The Tendon of these Muscles inserted into the *Olecranon* or Elbow.

e The Branch of an Artery on the *Anconeus*.



TAB. LI.

121 The *Palmaris Longus*.

A Its Origine, cut from the internal Protuberance of the *Os Humeri*.

B Its membranous Expansion, freed from the Palm of the Hand.

122 The inside of the *Palmaris Brevis*.

AA Its Membrane like Tendon, cut from the *Os Metacarpi Minimi Digiti*.

B Its Tendon inserted into the eighth Bone of the *Carpus*.

123 The internal Surface of the *Perforatus*, and

124 The external Surface of the *Perforans*, with

125 The *Lumbricales*, of the right Hand.

A The beginning of the *Perforatus*, from the internal Extuberance of the *Os Humeri*.

B Part of this Muscle, which, in this Subject, sent a small Tendon to the *Perforans*.

CC The Perforations, or Fissures, in the Tendons of the *Perforatus*, to transmit those of the *Perforans*.

cc Filaments from the Tendons of the *Perforatus*.

D The Original of the *Perforans*, cut from the *Ulna*.

EEE The Tendons of these Muscles, with the *Lumbricales*, cut off from their Insertions at the respective Internodes of the Fingers.

The other Figure shews the Musculi Interossei in Situ with some other Muscles, that appear in the Palm, after the preceding are removed.

FF The Bones of the Fingers, with their Semicircular Ligaments divided and expanded, after the Tendons CC, c, EE, are taken off.

G The *Ligamentum Transversale Carpi* divided and turn'd out; under which the Tendons leading to the Fingers pass.

H The Bone of the *Carpus*, from which part of the *Abductor Minimi Digiti* does arise.

I That Bone of the *Carpus*, to which the last mention'd Bone is connected.

K The Bones of the *Carpus*, where they are articulated with the *Radius*.

L The Bones of the Thumb, connected by their Ligaments.

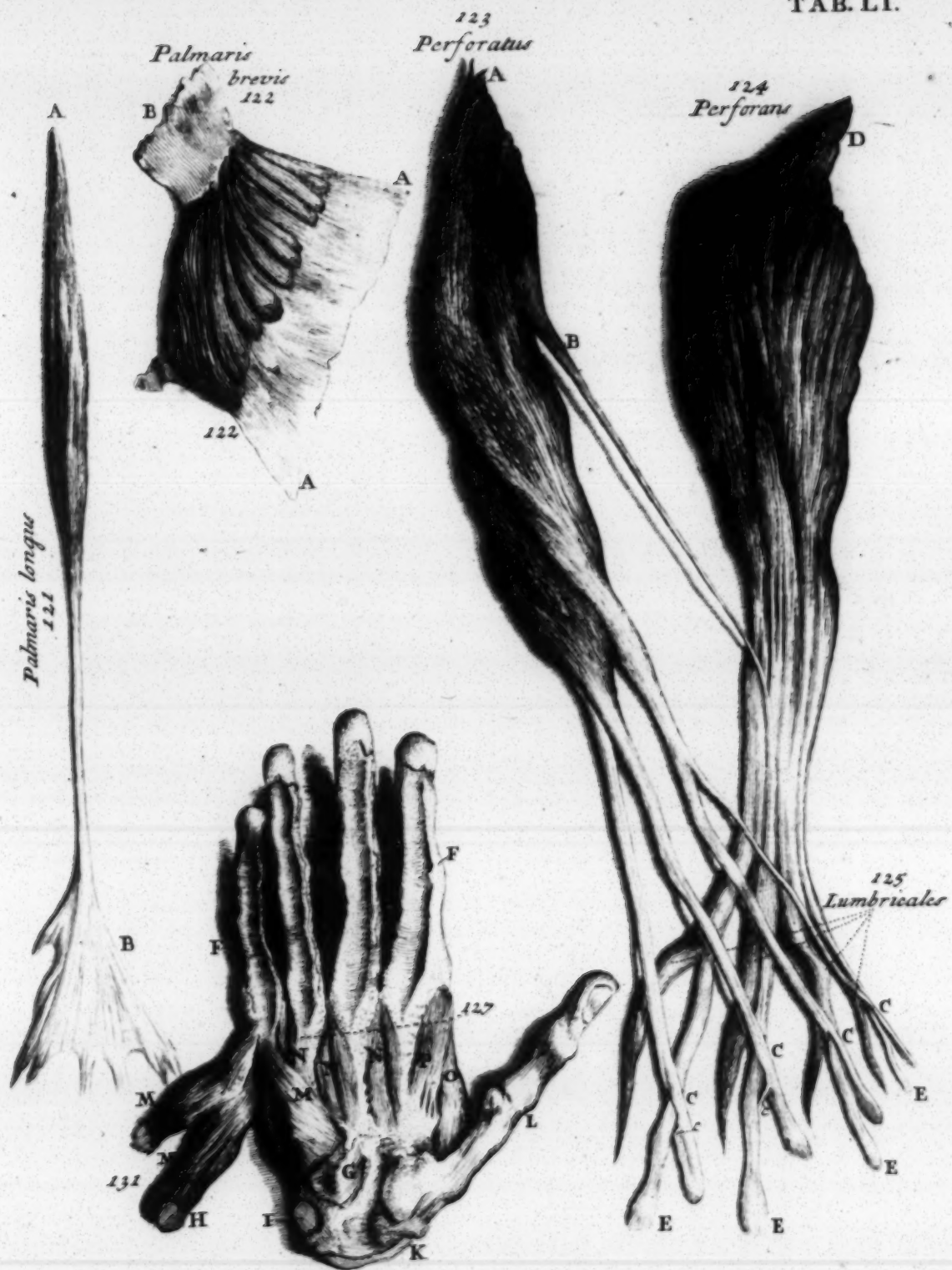
MMM The three Portions of the *Abductor Minimi Digiti*.

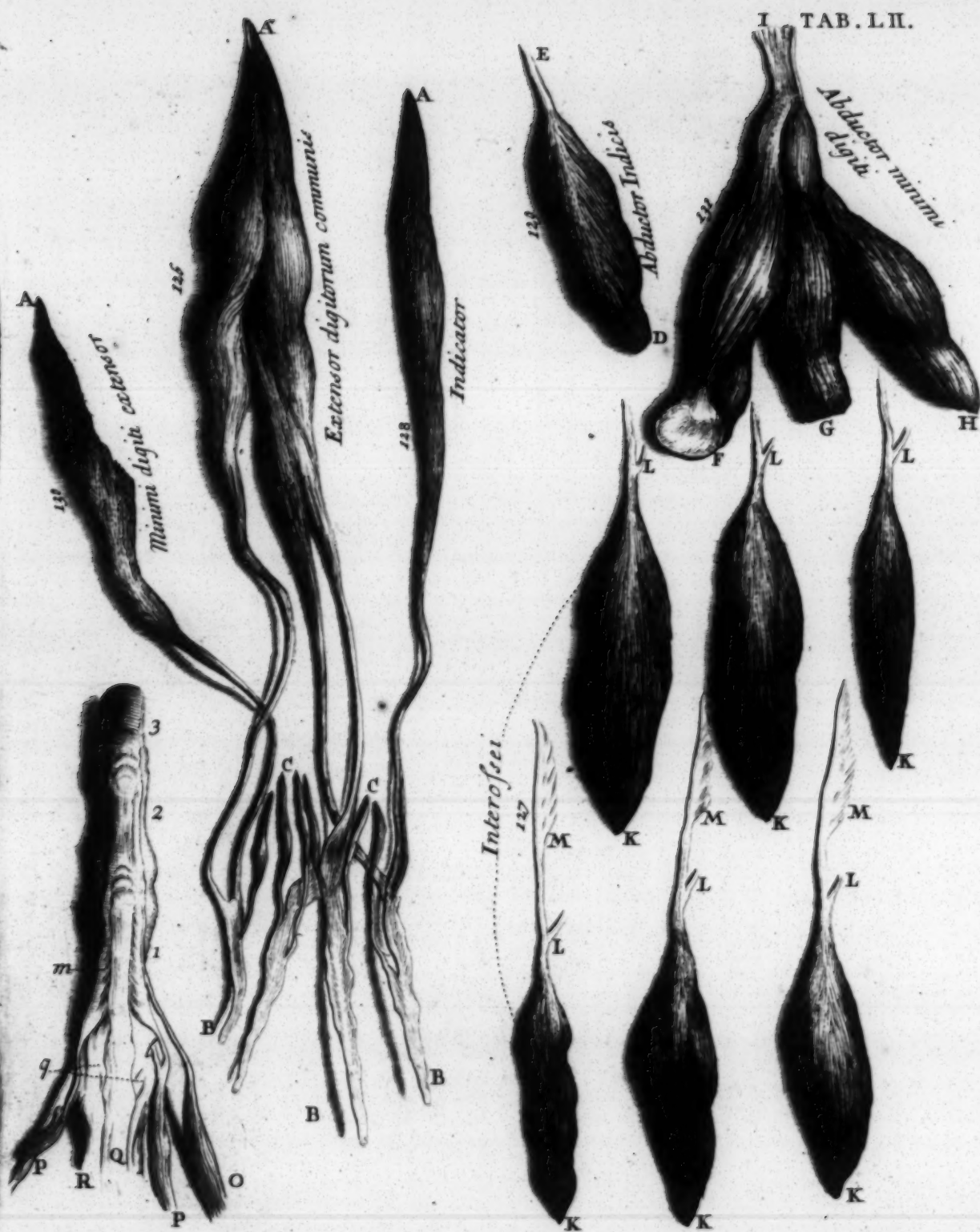
NN The *Interossei in Situ*.

O The *Adductor Pollicis*.

P Part of the *Abductor Indicis*, the rest of it lying under the last mention'd Muscle of the Thumb.

TAB. LI.





TAB. LII.

- 126 The internal Surface of the *Extensor Digitorum Communis*.
 128 The *Indicator*, and
 130 The *Extensor Minimi Digiti*.
 A A A Their several distinct Originations, which are variously united in different Subjects, before they come to
 B B B Their Insertions into the Fingers.
 C C The *Lumbricales*.
 129 The *Abductor Indicis*, as big as the Life.
 D Its fleshy Origine from the *Os Metacarpi* of the fore Finger.
 E Its tendinous Ending with the *Indicator*.
 131 The *Abductor Minimi Digiti*, as big as the Life.
 F One of the Bones of the *Carpus*, from which it takes one of its Origines.
 G H Its two other Beginnings.
 I The Termination of this Muscle, cut from the first Bone of the little Finger.
 127 The six *Interossei* of the Hand, as big as the Life.
 K K Their fleshy Originations freed from the Metacarpal Bones.
 L M Their long Tendons, which send Slips to the first Internode of each Finger, L. M, their other Parts, which join with the Tendons of the *Extensor Digitorum Longus*, in the manner express'd in the following Figure.
 1, 2, 3 The first, second, and third Internodes of the Finger, with its extending Tendons.
 O Part of one of the *Lumbricales*.
 P P Parts of the *Interossei*, on both sides.
 Q The Tendon of the *Extensor Digitorum Longus*.
 q Its two Slips, that are inserted into the upper part of the first *Internodium*.
 m The Fibres of the Tendons of the *Interossei*, joining with the *Extensor Digitorum Longus*.
 l The Slip sent off to the first Joint of the Finger.
 R Part of one of the Bones of the *Metacarpus*.

TAB. LIII.

132 *Flexor Pollicis Longus.*

A One of the Beginnings of this Muscle, (which is not commonly found) from the internal Protuberance of the *Os Humeri*.

a* Its second Beginning from the *Radius*.

B Its Tendon, ending in the superiour part of the third Bone of the Thumb.

133 *The Abductor Pollicis.*

A Its fleshy Origination from the *Os Carpi*, to which the Thumb is articulated, and the *Ligamentum Transversale Carpi*.

B Its tendinous Ending at the superiour and external part of the second Bone of the Thumb laterally.

C A Tendon we commonly meet with, sent to this Muscle from the *Extensor Primi Internodii Pollicis*.

134 *The Flexor Primi & Secundi Offis Pollicis*, as big as the Life.

AAA Its three fleshy Beginnings, from the *Ligamentum Transversale Carpi*, Bones of the *Carpus*, and *Os Metacarpi* of the middle Finger.

B Its Tendon, inserted into the first and second Bone of the Thumb.

CC Two *Offa Sefamoidea* in its Tendon.

135 *The Adductor Pollicis*, as big as the Life.

A Its fleshy Origination from the *Os Metacarpi Indicis*.

B Its Tendon, inserted into the superiour part of the first Bone of the Thumb.

136 *The Extensor Primi Offis Pollicis.*

A Its Origination from the *Ulna*.

B Its two Tendons, as they appear'd in this Subject, one of which sent a Slip, C, to the *Abductor Pollicis*, before they were both inserted into the lower part of the first Bone of the Thumb.

137 *The Extensor Secundi Offis Pollicis.*

A Its fleshy Origine from the *Radius*.

B Its Tendon, ending in the lower part of the second Bone of the Thumb.

138 *The Extensor Tertii Offis Pollicis.*

AA Its broad, partly tendinous, but chiefly fleshy, Origination from the *Ulna*.

B Its Tendon, cut from the lower part of the third Bone of the Thumb.

139 *The Flexor Carpi Radialis.*

A Its Origination.

B Its Insertion.

140 *The Flexor Carpi Ulnaris.*

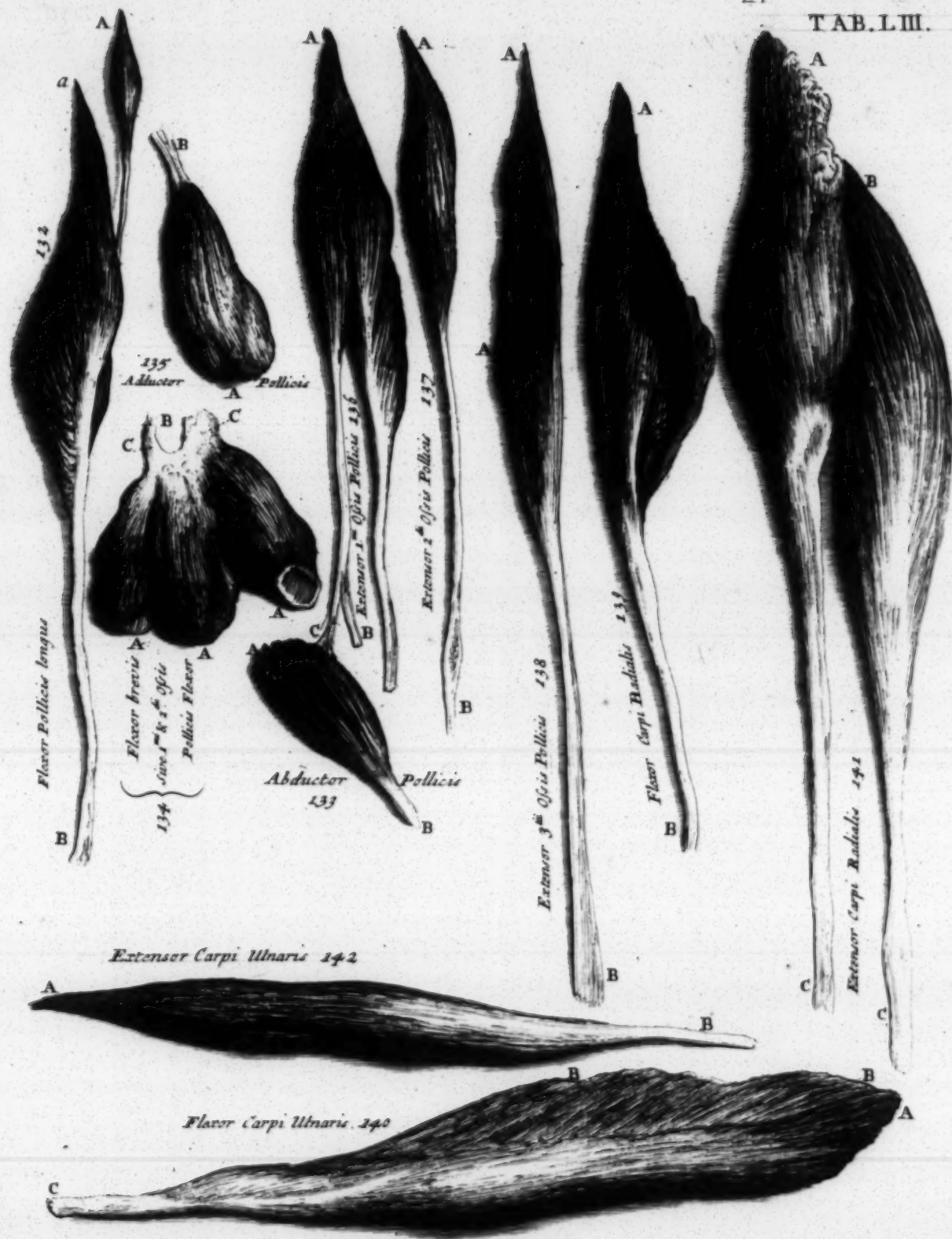
A Its tendinous Beginning from the internal Extuberance of the Shoulder Bone.

BB From the *Ulna*.

C Its Tendon, inserted into the fourth Bone of the *Carpus*, and the *Os Metacarpi* that sustains the little Finger.

141 *The inside of the Extensor Carpi Radialis.*

A The



EXPLANATION of the TABLES.

181

A The outermost Head, which springs fleshy from above the external Protuberance of the *Os Humeri*.

B The innermost Beginning of this Muscle, which arises from the *Os Humeri* below the former, as also from the upper part of the *Radius*.

C C Their two Tendons, that end in the superiour Parts of the *Ossa Metacarpi* of the fore and middle Fingers.

142 The *Extensor Carpi Ulnaris*.

A Its Origination from the outward Extuberance of the *Os Humeri*.

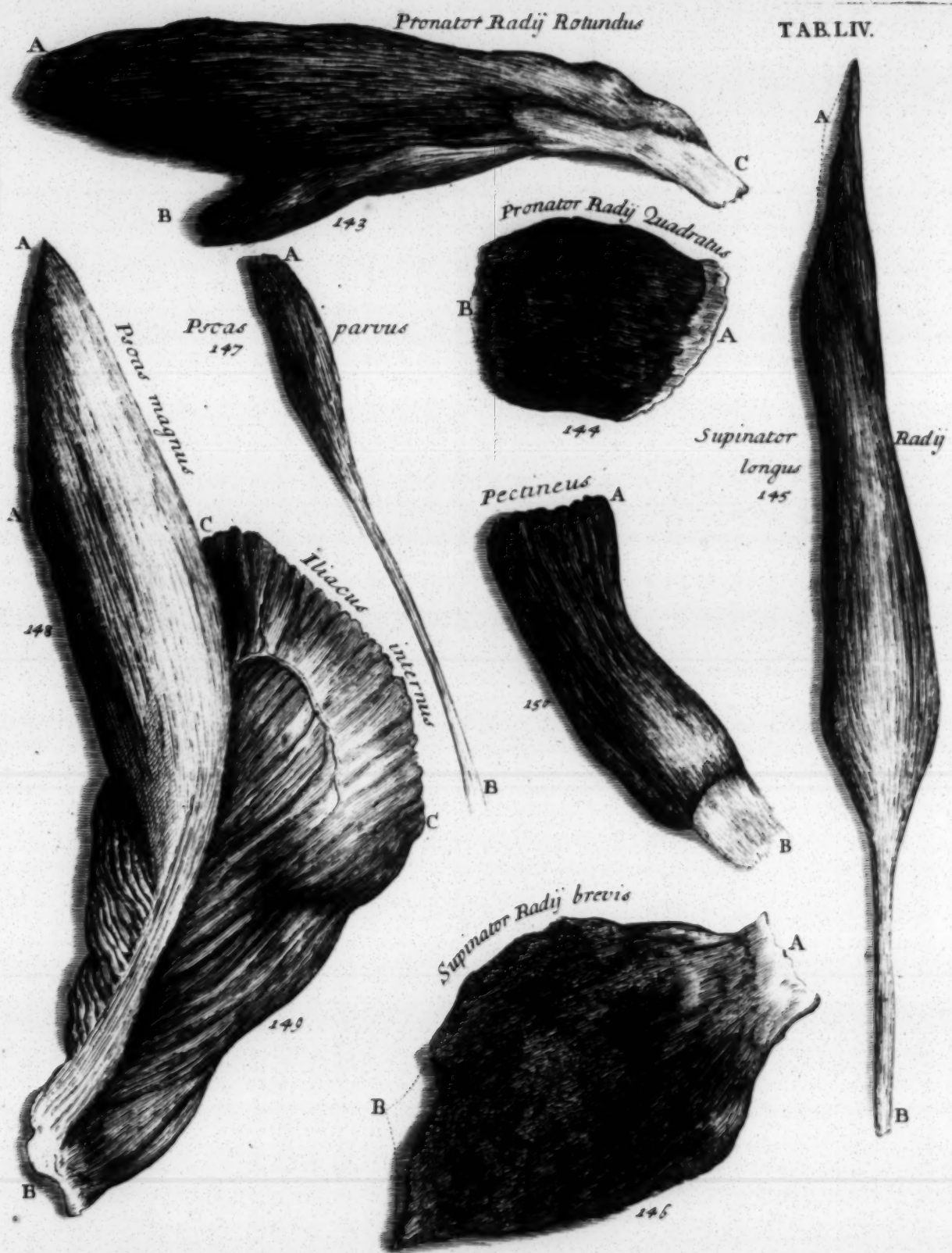
B Its Tendon, inserted into the superiour part of the Metacarpal Bone of the little Finger.

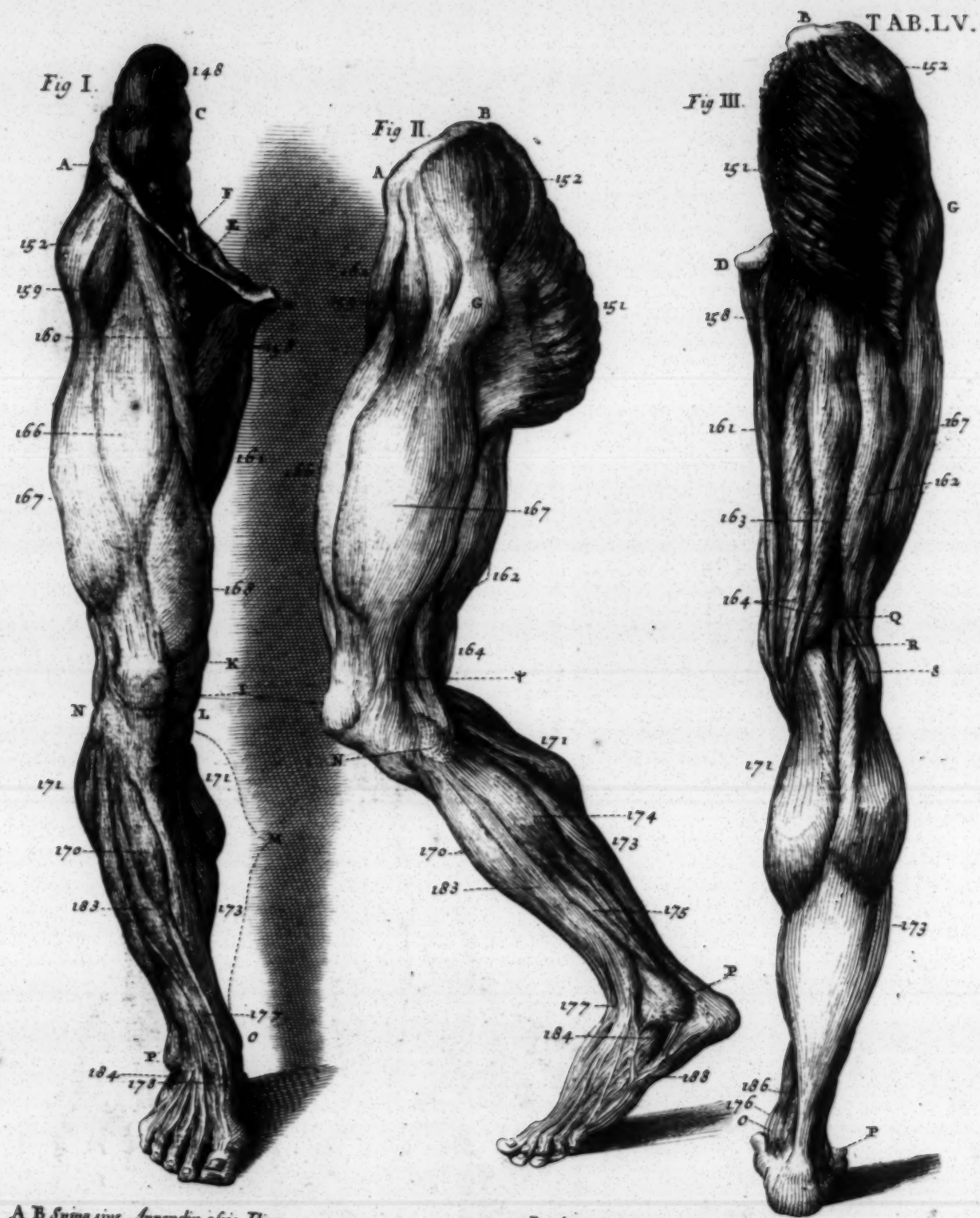


TAB. LIV.

- 143 The Inside of the *Pronator Radii Teres*, as big as the Life.
 A Its first Original from the internal Extuberance of the *Os Humeri*.
 B The second from the *Ulna*.
 C Its tendinous Infertion freed from the *Radius*.
- 144 The Inside of the *Pronator Radii Quadratus*, as big as the Life.
 A Its tendinous Origine from the *Ulna*.
 B Its fleshy Termination on the *Radius*.
- 145 The Inside of the *Supinator Radii Longus*.
 A Its broad fleshy Origination from the *Os Humeri*.
 B Its Tendon, ending in the lower and internal part of the *Radius*.
- 146 The Inside of the *Supinator Radii Brevis*, as big as the Life.
 A Its Origine from the superiour and external part of the *Ulna*.
 B Its Infertion into the Body of the *Radius*.
- 147 The *Psoas Parvus*.
 A Its Origination.
 B Its Termination.
- 148 The external Surface of the *Psoas Magnus*, with the internal Surface of the *Iliacus Internus*, to which it is inseparably joined.
 A A Its Original from the *Vertebrae* of the Loins.
 B Its Termination, which is partly tendinous and partly fleshy, at the inferior part of the lesser *Trochanter* of the Thigh-bone.
- 149 The *Iliacus Internus*.
 C C Its fleshy Origine from above half the superiour internal concave Part of the *Os Ilium*.
- 150 The *Pectineus*.
 A Its fleshy Original from the *Os Pubis*.
 B Its tendinous Ending on the *Os Femoris*.

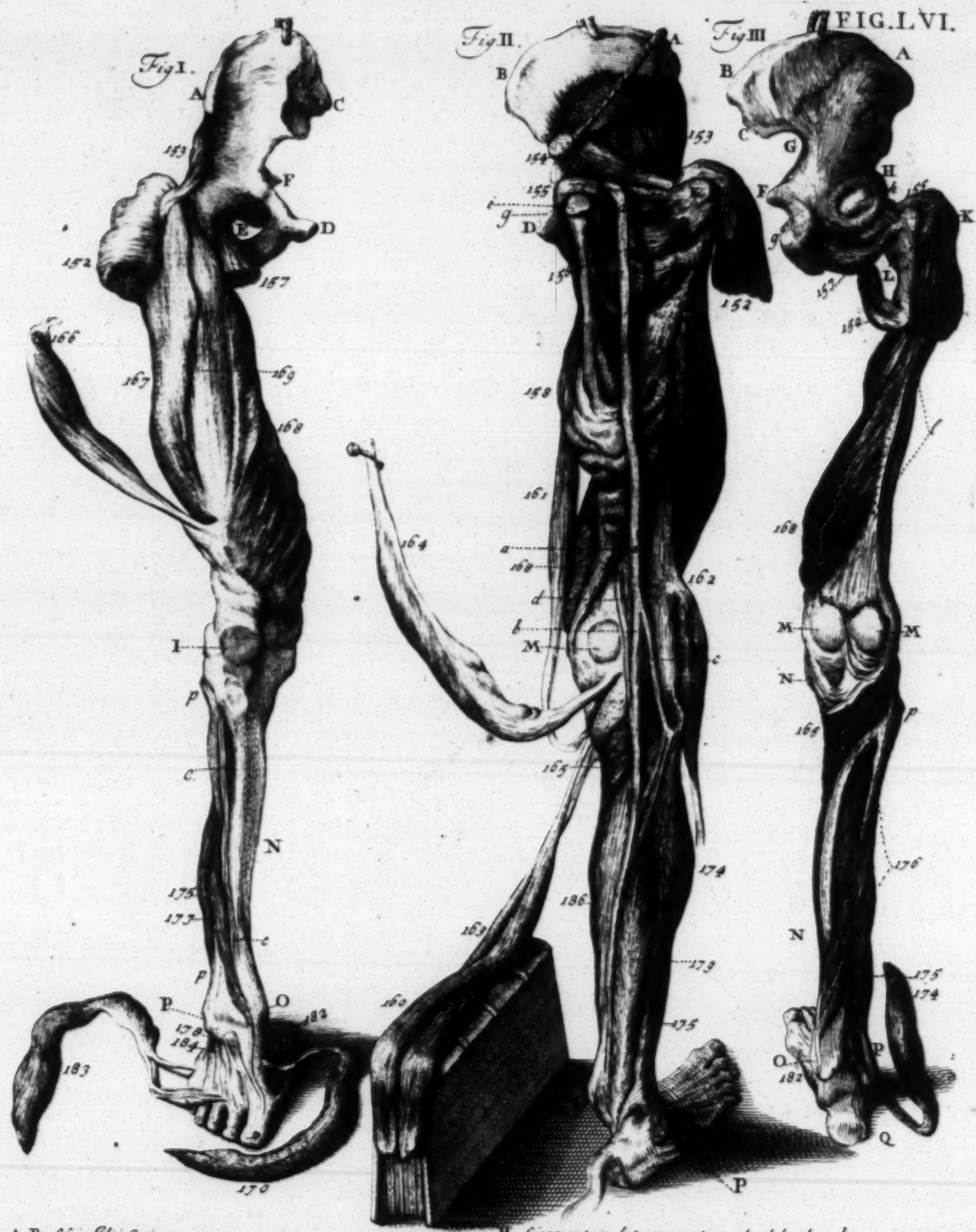






A B Spina sive Appendix ossis Ilium.
 C Ossis Ilium sedes posterior, ab ossis sacro divissa.
 D Os Pubis.
 E Obliqui descendens Tendinis portio.
 F Arteria & Vena Cruralis Trunci.
 G Trochanter major.
 H Glandula inguinalis.
 I Patella.
 K Ossis Femoris Appendix inferior.

L Appendix superior Ossis Tibiae.
 M Os Tibiae.
 N Membranae Tendinis.
 O Fibulae Appendix superior.
 P Malleolus Internus.
 Q Malleolus Externus.
 R Divisio Nervi Cruralis.
 S Ramus interior ac crassior.
 T Ramus exterior ac minor.

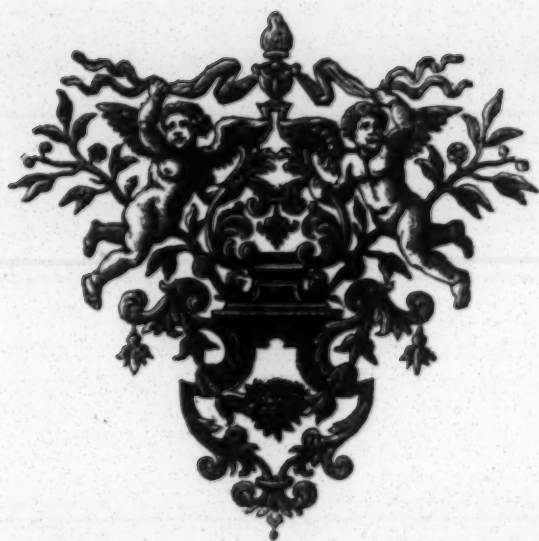


A. B. Os ilii Spina.
 a. Nervus Cruralis.
 b. ejus Ramus interior & major.
 c. Ramus minor.
 d. Arteria & Vena Cruralis Truncus.
 e. Arteria Vena Nervus Truncus.
 C. Os ilii Sinus inaequalis Os sacro liberatus.
 D. Os Pubis & ejus Foramen.
 E. Proccipus acutus Coxendici.
 G. Sinus Coxendici pro Mus^o Pterygiformis transitu.
 g. Appendix Coxendici.

H. Ligamentum latum apertum ad exhibendum h.
 h. Os Femoris Caput.
 i. Ligamentum Os sacro dissociatum.
 I. Patella.
 K. Trochanter major.
 L. L. Os Femoris. L. ejus Epipa Aspera.
 M. M. Capita Appendicis inferioris.
 N. Os Tibia. O. Malleolus internus.
 P. p. Fibula. P. Malleolus externus.
 Q. Os Calcis.

TAB. LV. LVI.

Need no other Explication than the References engrav'd at the bottom of the Plates, and the general Syllabus of the Muscles.



TAB. LVII.

151 The Inside of the *Gluteus Magnus* of the left Side, together with its lateral Tendon, which is joined with the Tendon of the *Musculus Membranofus*.

AA Its tendinous Origine from the Spine of the *Os Ilium*.

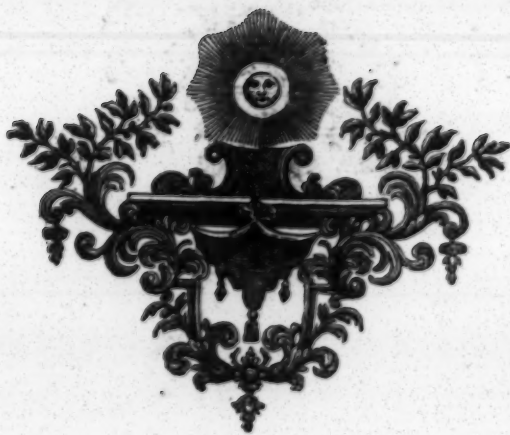
BB The fleshy Origine of this Muscle, from the Spine of the *Os Ilium*, *Os Sacrum* and *Os Coccygis*.

CC The great tendinous Termination of this Muscle, cut from the *Linea Aspera* of the *Os Femoris*.

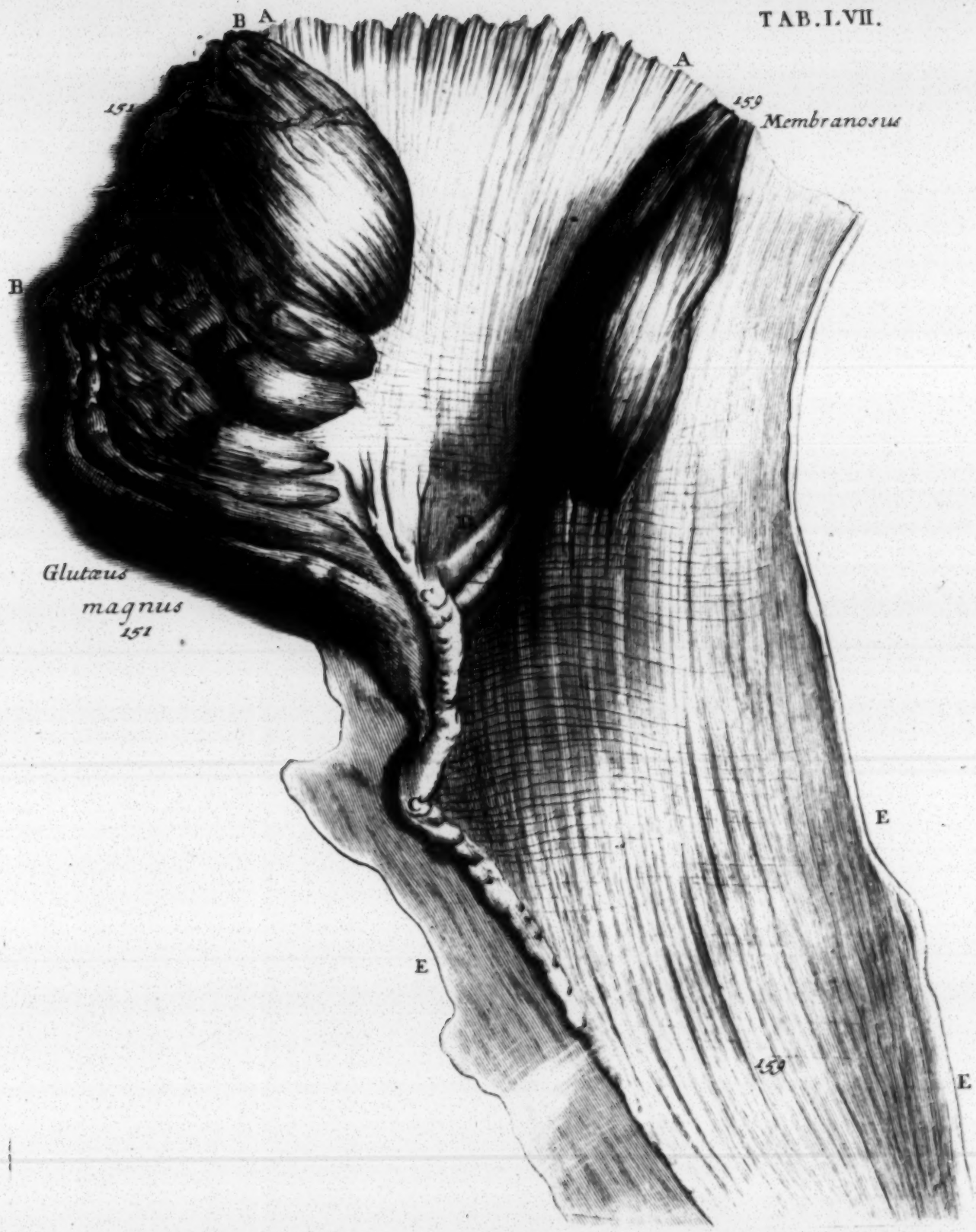
D The other broad Tendon of this Muscle, which is united with the Tendon of the *Membranofus*.

159 The *Membranofus*, cut from its fleshy Origine at the fore part of the Spine of the *Os Ilium*.

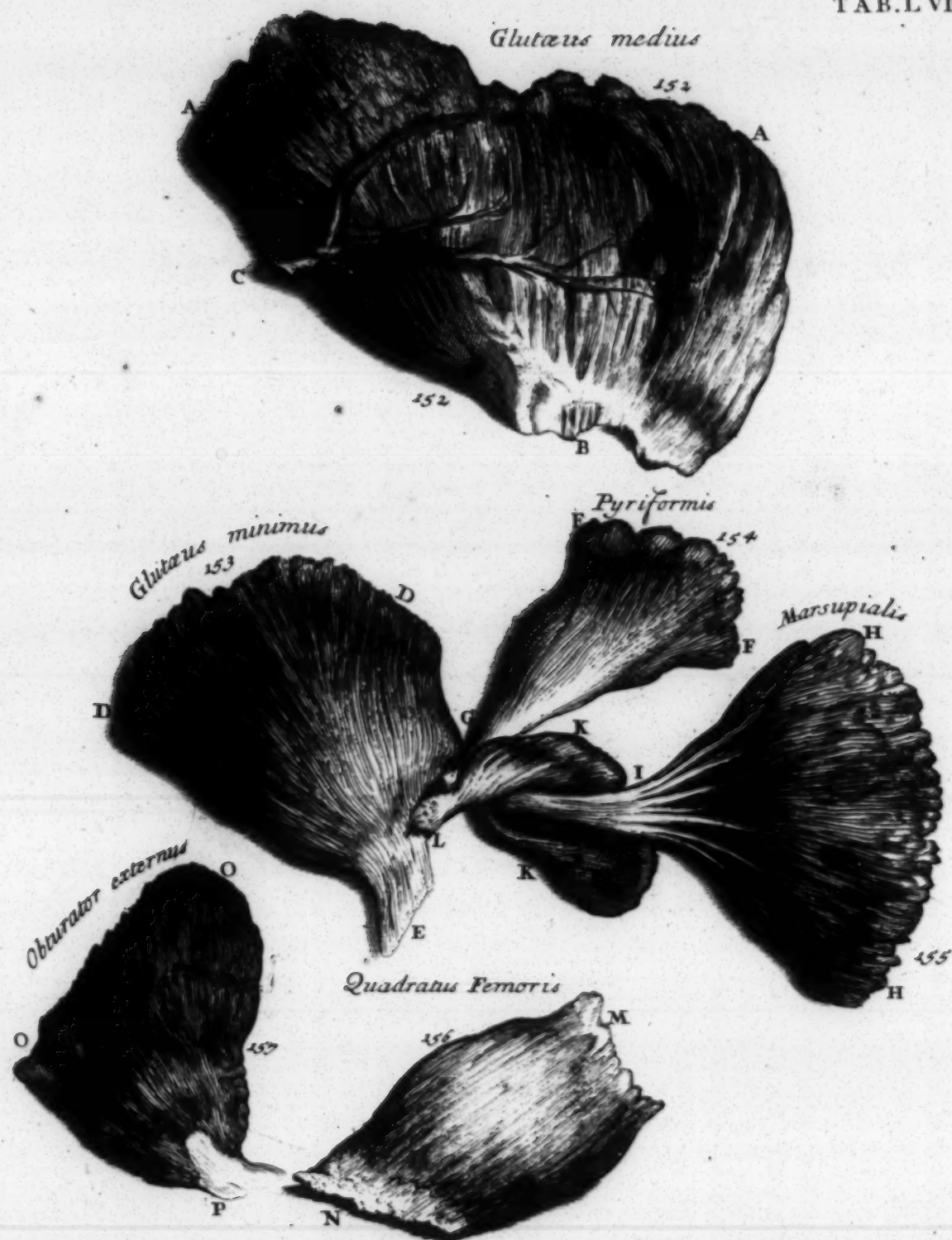
EE Part of its membranous Expansion, together with that of the *Gluteus*, freed from the Muscles of the Thigh.



TAB. I. VII.



TAB. LVIII.



TAB. LVIII.

- 152 The Inside of the *Glutæus Medius* of the left Thigh.
 AA Its Original, cut from the Spine of the *Os Ilium*.
 B Its short strong Tendon, cut from the superiour and external part of the great *Trochanter*.
 C The Trunk of an Artery with its Branches fill'd with Wax.
 153 The external Surfaces of the *Glutæus Minimus*, and
 154 The *Pyriformis*, with
 155 The *Marsupialis*, together with its *Marsupium*, of the left Thigh.
 DD The Origination of the *Glutæus Minimus* from the back part of the *Os Ilium*.
 E Its Tendon, freed from its Implantation into the superiour part of the Root of the great *Trochanter*.
 FF The Origine of the *Pyriformis* from the *Os Sacrum*, in the *Pelvis* of the *Abdomen*.
 G Its Tendon, cut from its Insertion into the Root of the *Trochanter*; where it is joyn'd to the Tendon of the *Marsupialis*.
 HH The Origine of the *Marsupialis* from the *Os Ilium*, *Ischium* and *Pubis*.
 I Its Tendons, that pass the *Sinus* of the *Ischium*.
 KK Its *Marsupium* open'd, to shew the Progress of its Tendon.
 L The Tendon of the *Marsupialis*, cut from the Root of the great *Trochanter*.
 156 The *Quadratus Femoris*.
 M Its Origine from the *Ischium*.
 N Its Termination at the posteriour part of the *Os Femoris*, below the great *Trochanter*.
 157 The external Surface of the *Obturator Externus*.
 OO Its Origine from the *Os Ischium*, and *Pubis*.
 P Its Tendon inserted at the Root of the great *Trochanter*.
 Q A Blood Vessel on its outside.

TAB. LIX.

158 The Inside of the *Triceps* of the left Thigh.

A The first describ'd Head, and largest beginning of the *Triceps*, that springs from the *Os Ischium* and *Pubis*.

B The second Head, or tendinous beginning of it, cut from the *Os Pubis*.

C The third beginning of the *Triceps*.

D Its strong round Tendon, cut from the upper part of the lower *Appendix* of the Thigh Bone.

EE The Tendon of the *Triceps*, freed from its Insertion into the *Linea Aspera* of the Thigh Bone.

160 The *Sartorius*.

F Its Origine from the Spine of the *Os Ilium*.

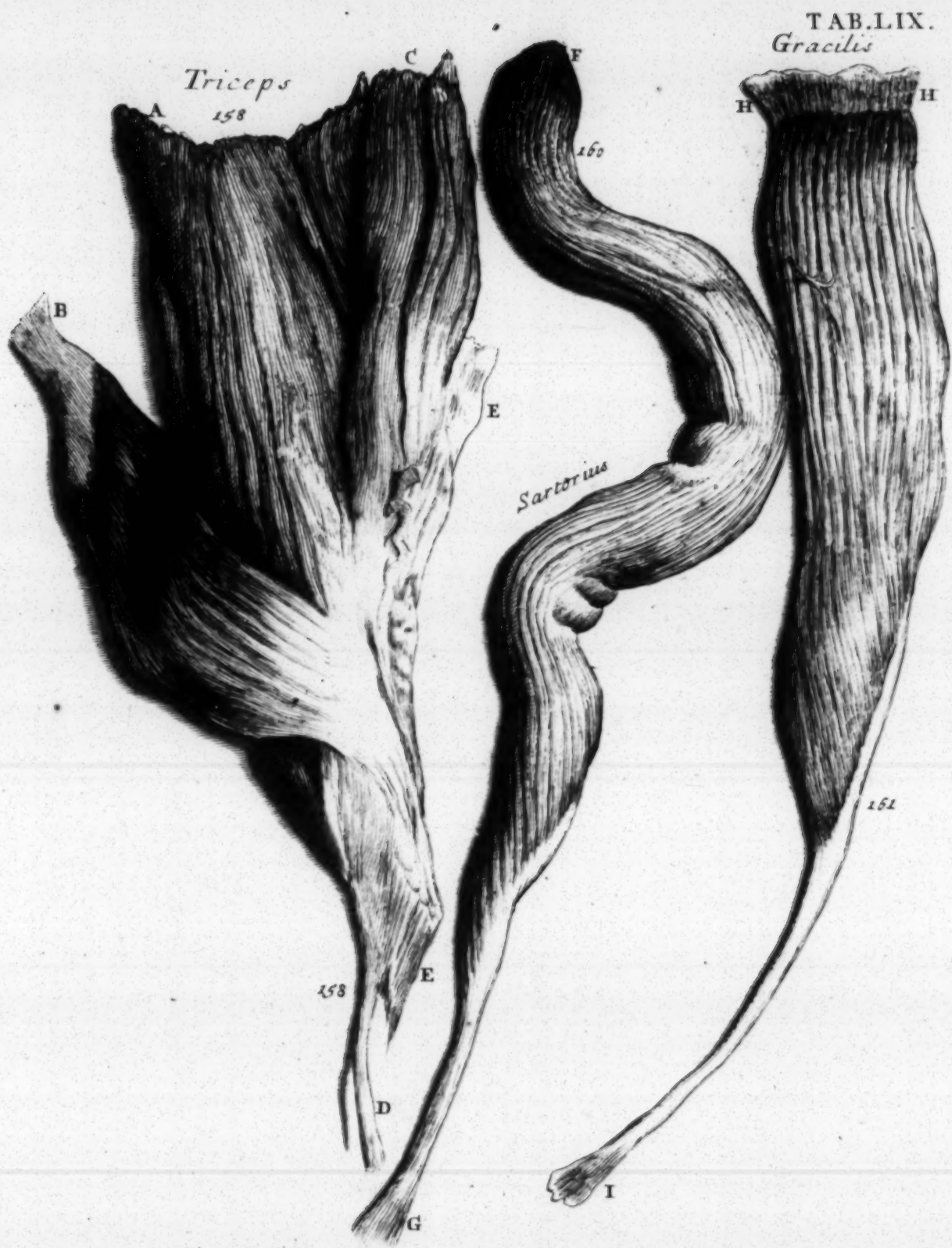
G Its Termination on the *Tibia*.

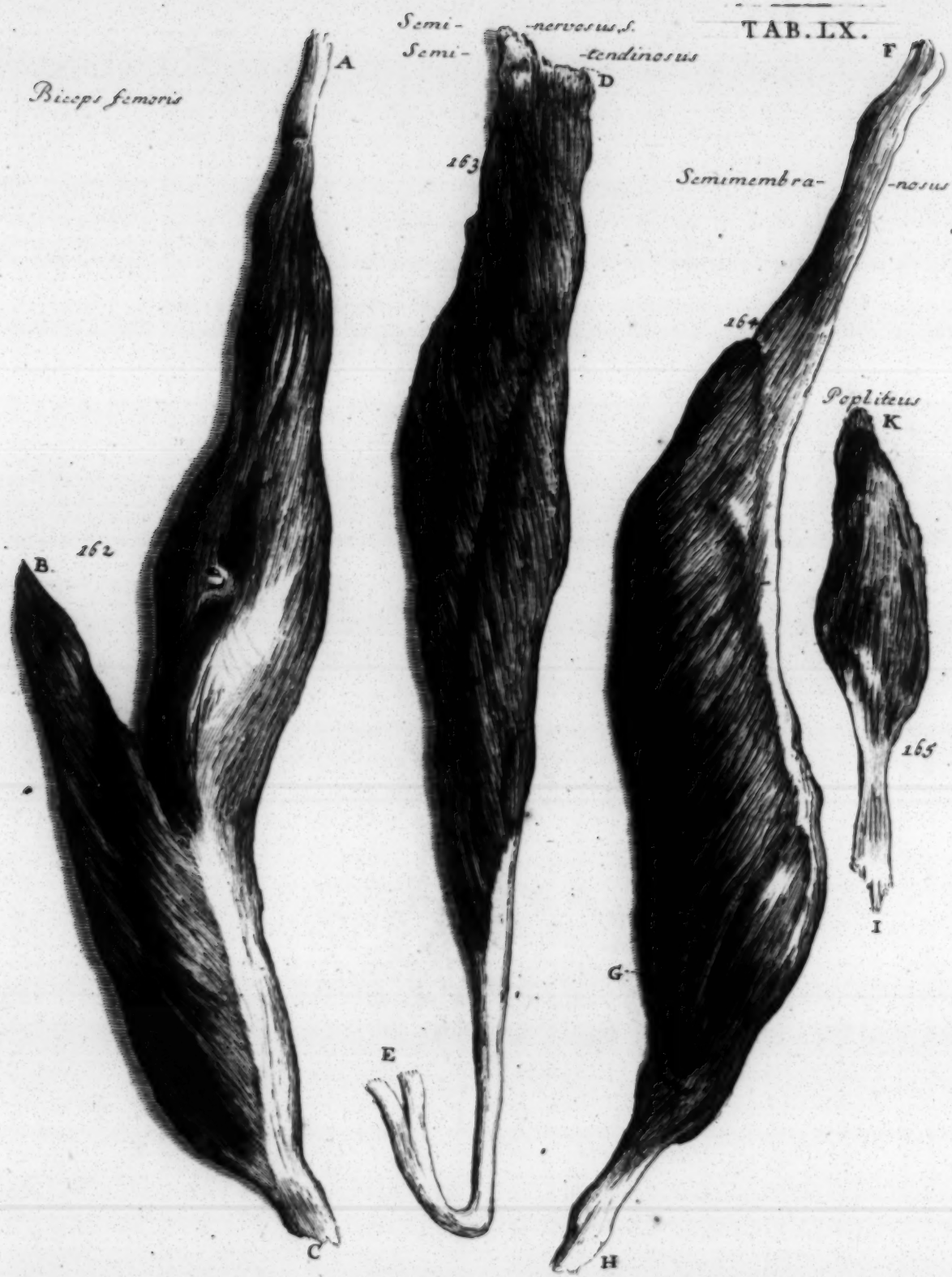
161 The Inside of the *Gracilis*.

HH Its broad tendinous Origine from the *Os Pubis*.

I Its Termination on the *Tibia*.







TAB. LX.

- 162 The external Surface of the *Biceps* of the left Thigh.
 A The superiour Head of this Muscle, which is a round Tendon, cut from the Protuberance of the *Os Ischium*.
 B The lower Head of the *Biceps*, cut from the *Linea Aspera* of the Thigh Bone.
 C Its Tendon, ending on the superiour *Epiphysis* of the *Fibula*.
 163 The outside of the *Seminervosus*, or *Semitendinosus*, of the same Thigh.
 D Its tendinous and fleshy Origine from the *Ischium*.
 E Its Tendon, in this Subject divided, at its Insertion into the *Tibia*.
 164 The outside of the *Semimembranosus* of the right Thigh.
 F Its flat tendinous Origine cut from the *Ischium*.
 G An Impression, made in this Muscle, by the Tendon of the *Seminervosus* passing over it.
 H Its Tendon, cut from its Termination on the superiour part of the upper *Appendix* of the *Tibia*.
 165 The inside of the *Popliteus*.
 I Its tendinous Origine, from the external Head of the inferiour *Appendix* of the *Os Femoris*.
 K Its fleshy Termination, cut from the *Tibia*.

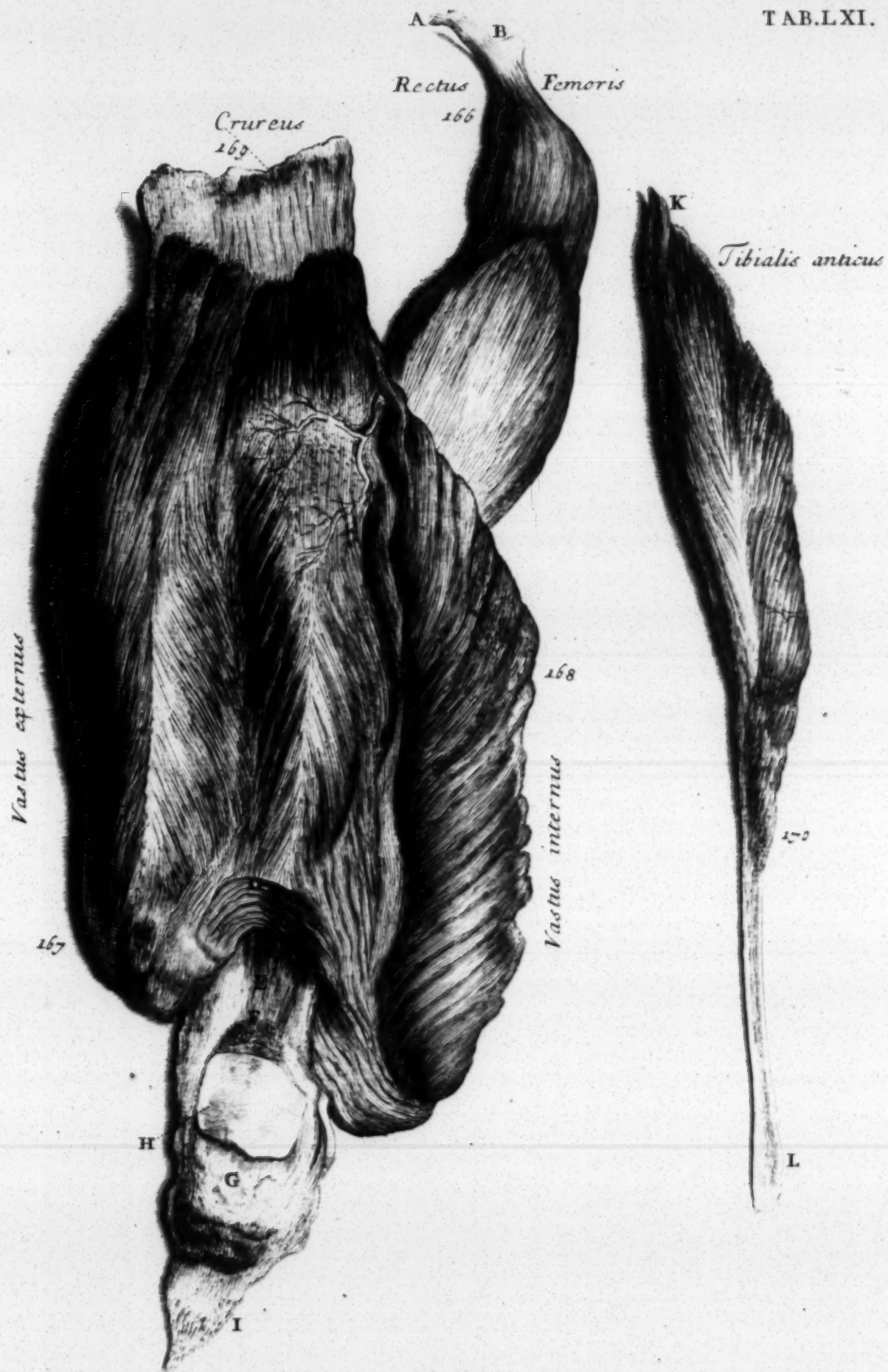


TAB. LXI.

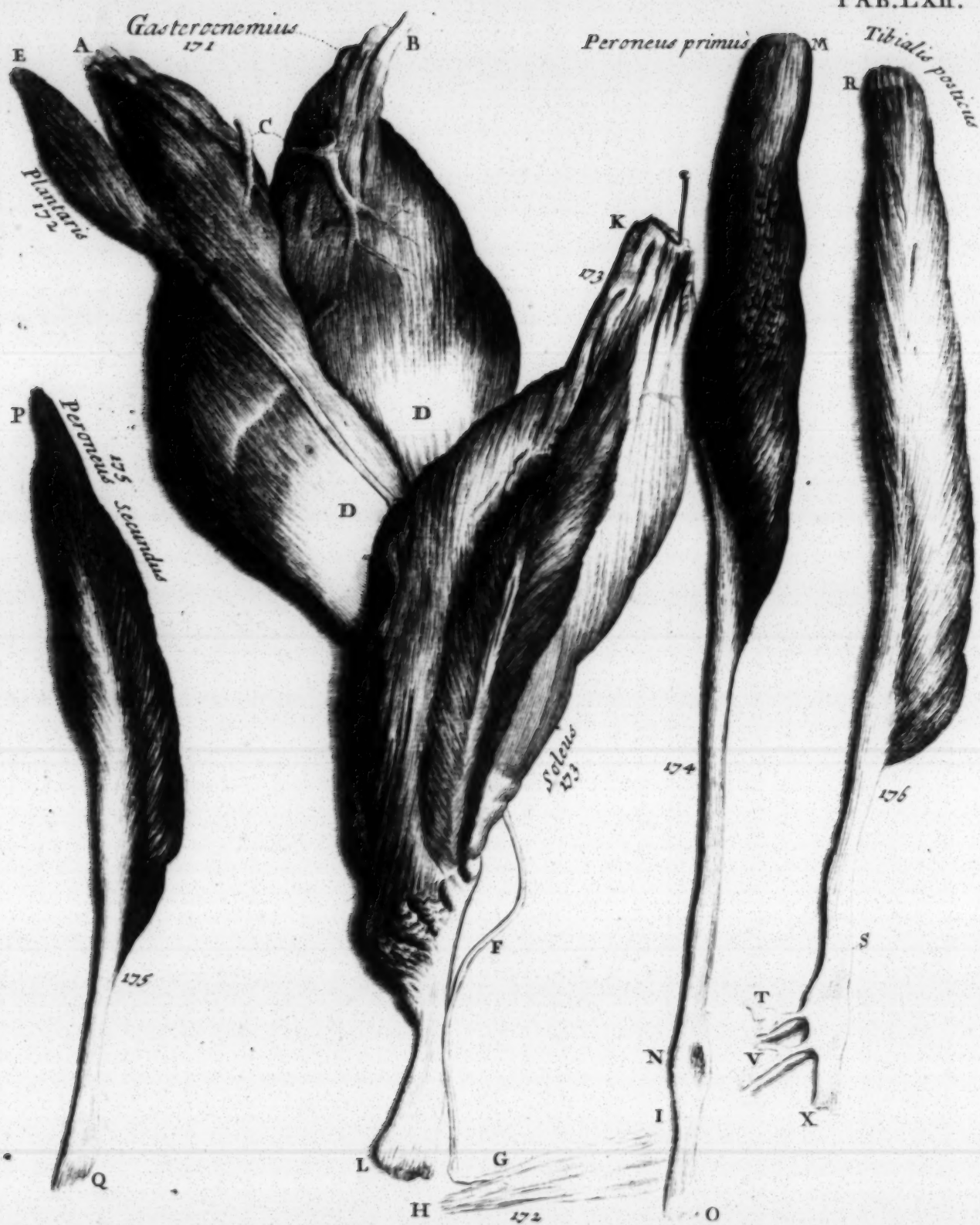
- 166 The internal Surface of the *Rectus Femoris*.
 A That part of its Origine, that springs from the Margin of the *Acetabulum*.
 B The other part of its Origine, from a Tubercle under the Spine of the *Os Ilium*.
 167 The internal Surface of the *Vastus Externus*.
 168 The internal Surface of the *Vastus Internus*.
 169 ————— *Crureus*.
 C The Branches of an Artery, on the internal Surface of the *Crureus*, next the *Os Femoris*.
 D A Transverse Order of Fibres, between the two *Vasti* on the *Crureus*.
 E The Tendon of the *Crureus*, joyn'd with those of the two *Vasti*.
 FG The mucilaginous Glands on these Tendons, above and below the *Patella*.
 H The internal Surface of the *Patella*.
 I The Termination of all these extending Muscles of the Leg, cut from the *Tibia*.
 170 The internal Surface of the *Tibialis Anticus*.
 K Its upper fleshy Part, cut from the *Tibia*.
 L Its Tendon, or lower Part, cut from the *Os Cuneiforme Majus*, and *Os Metatarsi* of the great Toe.



TAB. LXI.



TAB. LXII.



TAB. LXII.

171 The Inside of the *Gastrocnemius*, or *Gemellus*, of the right Leg, together with the *Plantaris* and *Soleus*.

A That Part of the *Gastrocnemius*, which arises from the external Tubercle of the Thigh Bone.

B Its other Beginning from the internal Tubercle of the same Bone.

C Some Trunks of Arteries fill'd with Wax, passing into this Muscle.

DD The internal tendinous Surface of this Muscle, next the external Tendon of the *Soleus*, by which these Muscles are render'd more apt to slide on each other, when they act.

172 The *Plantaris*.

E Its Original from the external Tubercle of the *Os Femoris*.

FF Its long flat Tendon, resembling a narrow Satin Ribband, passing between the *Gastrocnemius* and *Soleus*.

G Its tendinous Expansion, freed from the bottom of the Foot.

H The tendinous Expansion, that springs from the *Os Calcis*.

I That part of it, that terminated in the lower Parts of the *Ossa Metatarsi*, and the first Bones of the Toes.

173 The internal Surface of the *Soleus*, or *Gastrocnemius Internus*.

K Its tendinous and fleshy Origine from the upper *Appendix* of the *Fibula*.

L The Tendons of this and the *Gastrocnemius Externus*, at their united Insertion into the *Os Calcis*.

174 The inside of the *Peroneus Primus* of the right Leg.

M Its fleshy Fibres, cut from their Original at the superiour part of the *Fibula*.

N A small cartilaginous Body in the bending of the Tendon of this Muscle, as it passes on the *Os Cuboides*, from whence it runs to the bottom of the Foot.

O Its Termination on the *Os Metatarsi* of the great Toe.

175 The outside of the *Peroneus Secundus*.

P The upper Part, which springs from the *Fibula*.

Q Its tendinous Ending, cut from the *Os Metatarsi* of the little Toe.

176 The outside of the *Tibialis Posterior*, of the same Leg with the former.

R Its upper Part, that springs from the *Fibula*.

S That Part of its Tendon, which in old Bodies grows hard and bony, but in this Subject, who was young, did not appear so. This slips up and down, not unlike the *Patella* placed in the Tendons of the extending Muscles of the *Tibia*, whereby these Tendons are defended from any Attrition on the Bones they pass over.

TV Its tendinous Fibres, that terminate in the *Os Naviculare*.

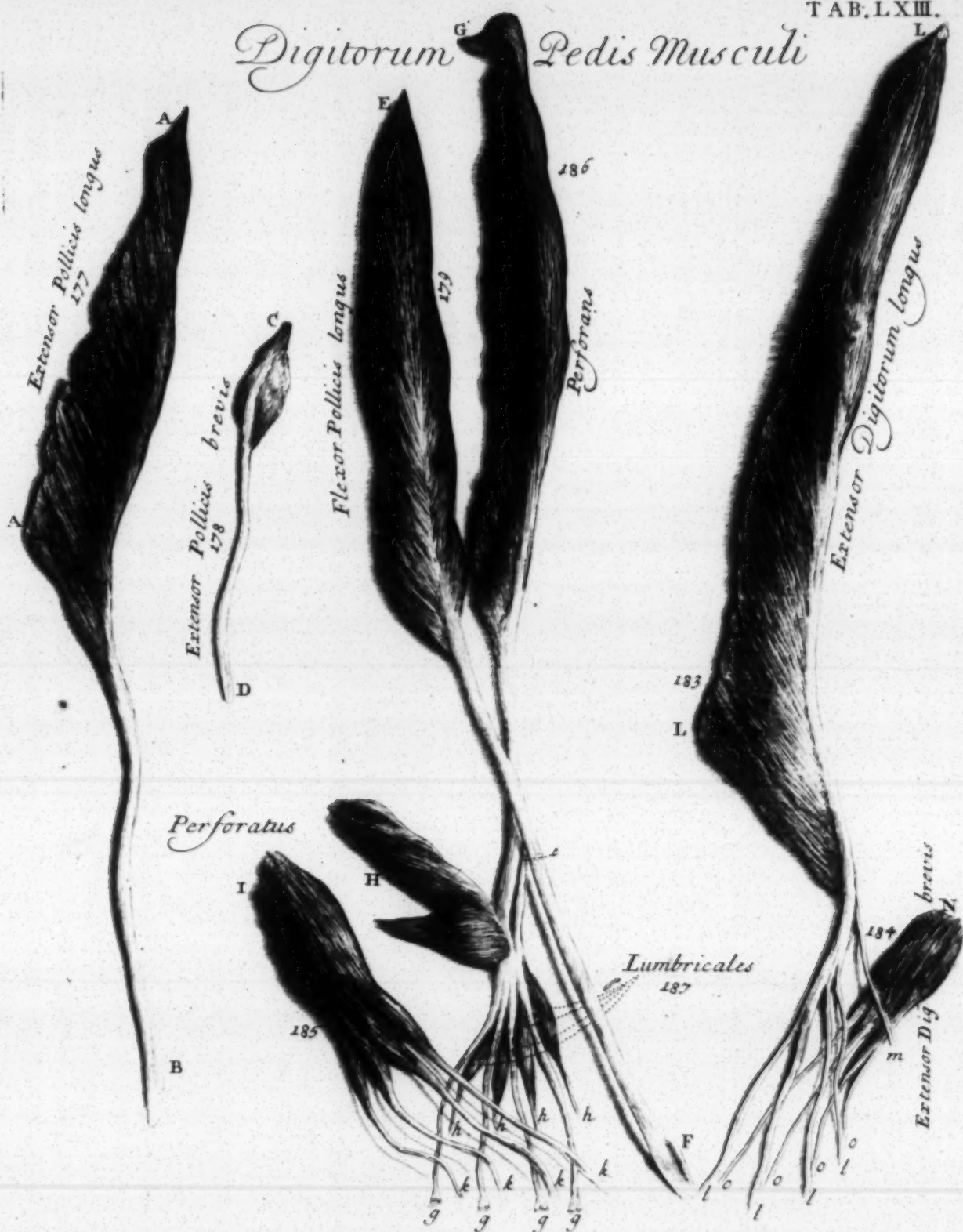
X The strong Tendon, that terminates in the *Os Cuneiforme Majus*.

TAB. LXIII.

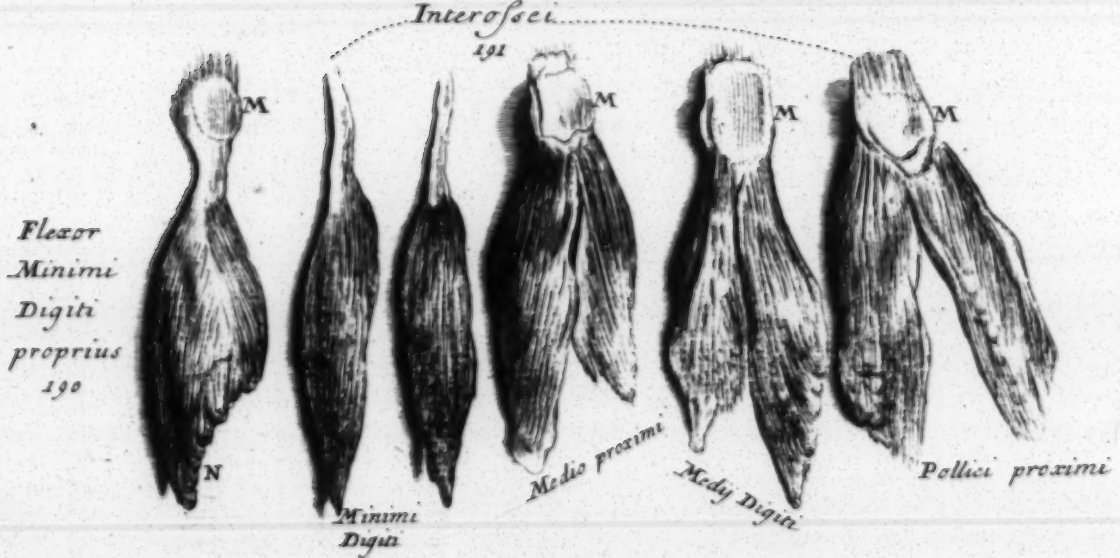
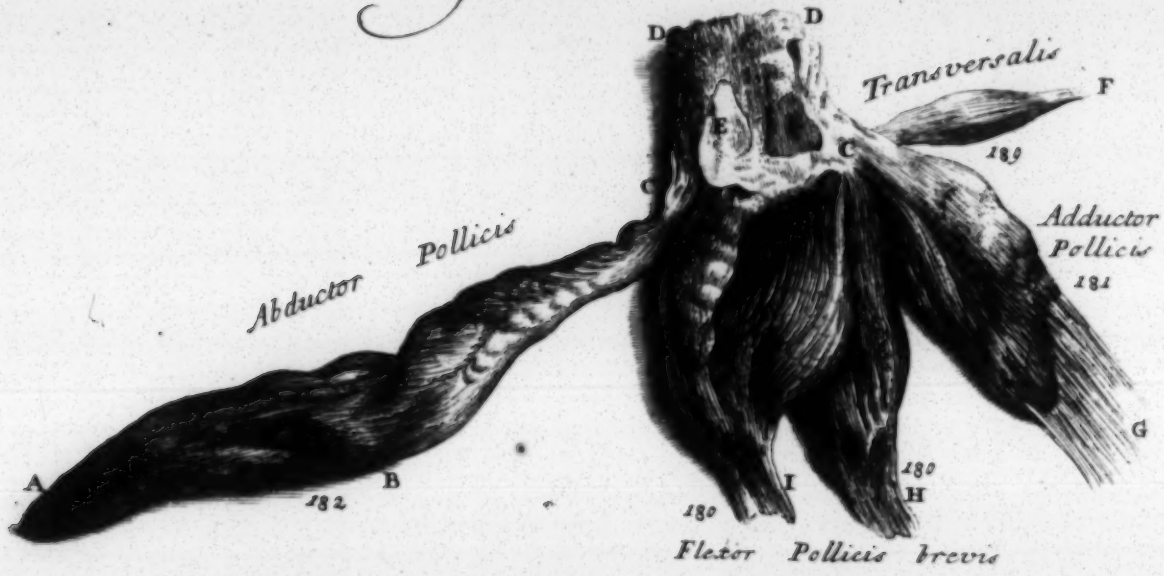
The Muscles of the Toes.

- 177 The underside of the *Extensor Pollicis Longus* of the right Foot.
 AA Its disgregated fleshy Original from the *Fibula*.
 B Its Tendon cut from the upper part of the second Bone of the great Toe.
 178 The *Extensor Pollicis Brevis* of the same Foot.
 C Its Origine from the superiour and fore part of the *Os Calcis*.
 D Its tendinous Ending, cut from the first Bone of the great Toe.
 179 The external Surface of the *Flexor Pollicis Longus*.
 E Its acute fleshy Original from the back part of the *Fibula*.
 e A Slip from the Tendon of this Muscle, going to the Tendons of the *Perforans*, as it passes the bottom of the Foot.
 F The broad Extremity of its Tendon, cut from the last Bone of the great Toe.
 183 The exteriour Surface of the *Extensor Digitorum Longus*.
 LL Its long fleshy Original from the upper *Appendix* of the *Tibia*, and fore part of the *Fibula*.
 m One of its Tendons, cut from the superiour part of the *Os Metatarsi* of the little Toe.
 llll Its four Tendons freed from the superiour Part of the third Bones of the four lesser Toes.
 184 The *Extensor Digitorum Brevis*.
 N Its fleshy Origine from the external and fore part of the *Os Calcis*.
 oooo Its four Tendons, which join with the former, near their Insertions into the third Bones of the Toes.
 185 The outside of the *Flexor Digitorum Perforatus*.
 I Its fleshy Original from the *Os Calcis*.
 kkkk Its four Tendons, (after being split, or perforated, to transmit the Tendons of the *Perforans*) cut from their Terminations on the second Bone of each lesser toe.
 186 The outside of the *Flexor Digitorum Perforans*.
 G Its acute fleshy Original from the back part of the *Tibia*.
 gggg Its Tendons, cut from the third Bone of each lesser Toe.
 187 The *Lumbricales*.
 H Their fleshy Original from the internal part of the *Os Calcis*. This is commonly call'd *Carnea Massa in Planta Pedis*.
 hhhh Their four Tendons, springing from their four fleshy Parts, and terminating on the inside of the four lesser Toes.

Digitorum Pedis Musculi



Digitorum Pedis Musculi



TAB. LXIV.

The Muscles of the Toes, as big as the Life.

- 180 The internal Surface of the *Flexor Pollicis Brevis*.
 HI Its two Beginnings in this Subject, from the *Os Cuneiforme Medium*.
 181 The internal Surface of the *Adductor Pollicis*.
 G Its broad tendinous Beginning, cut from the *Os Calcis*.
 C Its Tendon inserted into the internal *Os Sefamoideum*, E.
 182 The *Abductor Pollicis*.
 A Its first described fleshy Beginning from the *Os Calcis*.
 B The second, from the *Os Cuneiforme Majus*.
 C Its Tendon, inserted into the external side of the first Bone of the great Toe.
 EE The *Offa Sefamoidea*.
 DD The Terminations of the last mention'd Muscles, cut from the first Bone of the great Toe.
 188 The external Surface of the *Abductor Minimi Digiti*.
 K Its fleshy Original from the *Os Calcis*.
 L Its Tendon, cut from the first Bone of the little Toe.
 189 The *Transversalis Pedis*, left at its Original from the *Os Sefamoides* of the great Toe.
 F Its Termination, cut from the Cartilage of the first Articulation of the Toe next the little Toe, as well as that of the little Toe it self.
 190 The internal Surface of the *Flexor Minimi Digiti Proprius*.
 N Its Original from the *Os Metatarsi Minimi Digiti*.
 M Two *Offa Sefamoidea* in the Tendon of this Muscle, before it is inserted into the first Bone of the little Toe.
 191 The eight *Musculi Interossei*.
 MMM The *Offa Sefamoidea* in their Tendons.



TAB. LXV.

For the better explaining the Muscles on the Bottoms of the Feet, they are represented in the two following Tables, as they appear'd in the Dissection of the right Foot.

FIG. I. II.

The first shews the Appearance of the Bottom of the Foot, after the Skin and Fat is removed.

The second represents the external Tendons and Muscles dissected and display'd, to shew those under them in their natural Situation.

AA The *Os Calcis*.

BB Part of the *Malleolus Internus*.

C Fig. I. Part of the *Malleolus Externus*.

DD The superiour and external part of the *Os Metatarsi Minimi Digiti*.

EE One of the *Offa Sesamoidea* of the great Toe.

FF Fig. I. A transverse Ligament, which ties the first Internodes of all the little Toes together.

GGG Fig. II. The Channels, which are invested with Ligaments, that enclose the Tendons employ'd in bending the Toes.

172 The Tendon of the *Plantaris* as it appears on the bottom of the Foot, in its natural Situation, Fig. I.

The same rais'd and left to the *Os Calcis*, Fig. II.

1 Its Original from the *Os Calcis*.

111 Its Termination freed from the first Internodes of the lesser Toes.

180 *Flexor Pollicis Brevis*, Fig. II.

182 The *Abductor Pollicis in Situ*, Fig. I.

Rais'd from its Origine, Fig. II.

3 That part of the *Abductor Pollicis*, that arises from the *Os Cuneiforme Majus*.

13 Fig. II. V. Tab. 66. *

188 The *Abductor Minimi Digiti in Situ*, Fig. I.

Left at its Termination, Fig. II.

187 Fig. II. The *Carnea Massa in Planta Pedis*, which I take to be the true Original of the *Lumbricales*.

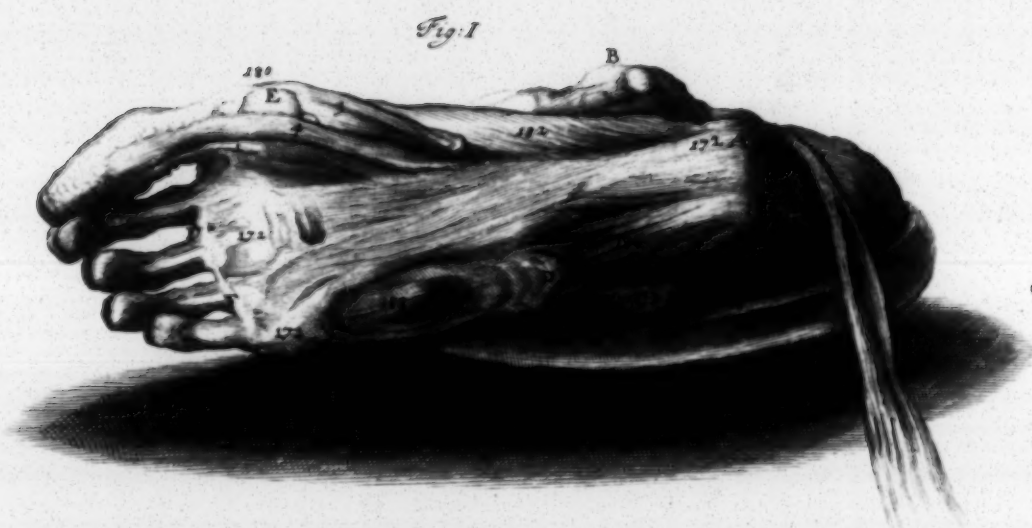
10 10 10 The *Musculi Lumbricales*, commonly so called.

4 The Tendon of the *Flexor Pollicis Pedis Longus*, lying under the Tendon of the *Perforans*.

186 The Tendon of the *Perforans*, to which the *Carnea Massa*, or *Musculi Lumbricales* adhere, soon after it crosses the *Flexor Pollicis Longus*.

185 The

TAB. LXV.



M. P. J. de la Roche Sculp.

185 The *Perforatus* raised from its Origine at the *Os Calcis*, and turned down. In this Subject there were but three Tendons from this Muscle, to three of the Toes only; but in others we commonly find four, inserted in to the second Internodes of each lesser Toe.

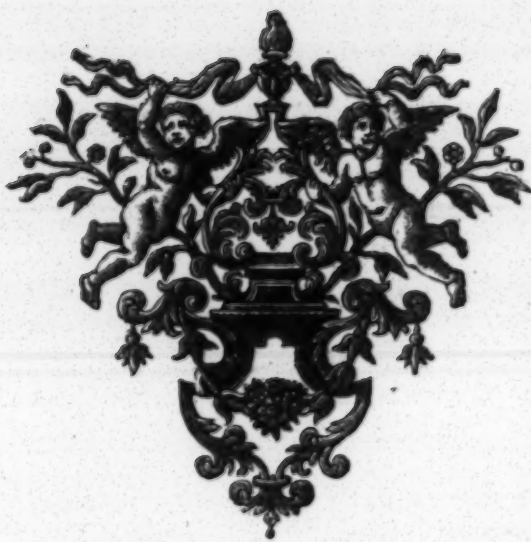
14 Fig. II. The Tendon of the *Gastrocnemii*, &c.

190 *Flexor Primi Internodii Minimi Digiti Proprius in Situ.*

5 The external *Interosseus*, improperly so call'd, of the little Toe.

1 Fig. I. The Tendon of the *Adductor Pollicis*.

11 Fig. II. The *Adductor Pollicis in Situ.*



TAB. LXVI.

FIG. I. II.

AA The *Os Calcis*.

BB The *Malleolus Internus*.

CC A Prominence in the *Os Cubiforme*, cover'd with a Cartilage, that is receiv'd by a small moving Cartilage, placed in the Tendon of the *Peronæus Longus*.

* 174.

D A Furrow or Chanel, in the *Os Calcis*, in which passes the Tendon of the *Flexor Pollicis Longus*.

E Another Chanel, partly on the *Os Calcis*, and partly on the *Astragalus*, for the Tendon of the *Flexor Digitorum Perforans*.

F Fig. II. The *Os Metatarsi* of the great Toe.

G *Ibid.* Its smooth cartilaginous *Appendices*, on which the *Ossa Sesamoidea*, h, h, placed in the Tendon of the *Flexor Pollicis Brevis*, move.

H *Ibid.* The Surface of the *Os Cuneiforme Majus*, to which the *Os Metatarsi* of the great Toe is articulated.

iiii *Ibid.* The four *Ossa Metatarsi* of the little Toes.

176. *Ibid.* Part of the *Tibialis Posticus*, next its Insertion into the *Os Cuneiforme Majus*.

174 *Ibid.* The Tendon of the *Peronæus Primus*, left at its Termination on the *Os Metatarsi* of the great Toe, F.

180 *Ibid.* The *Flexor Pollicis Brevis*.

181 *Ibid.* The *Adductor Pollicis*.

191 The *Interossei*.

10 10 10 Fig. I. The *Adductor Pollicis*.

8 Fig. I. The Tendon of the *Tibialis Anticus*, at its Termination.

2 *Ibid.* The *Os Cuneiforme Majus*.

9 *Ibid.* A rising of the *Os Calcis*, next the *Astragalus*.

5, 6 *Ibid.* The internal Surface of the *Lumbricales*, and that part of them call'd *Carnea Massa*, united with the Tendons of the *Perforans* in the *Planta Pedis*.

179 *Ibid.* The *Flexor Pollicis Longus*.

† Its tendinous Slip to the *Perforans*.

186 The *Perforans*.

8 F. II. The Tendon of the *Peronæus Secundus*.



F I N I S

Fig: II.

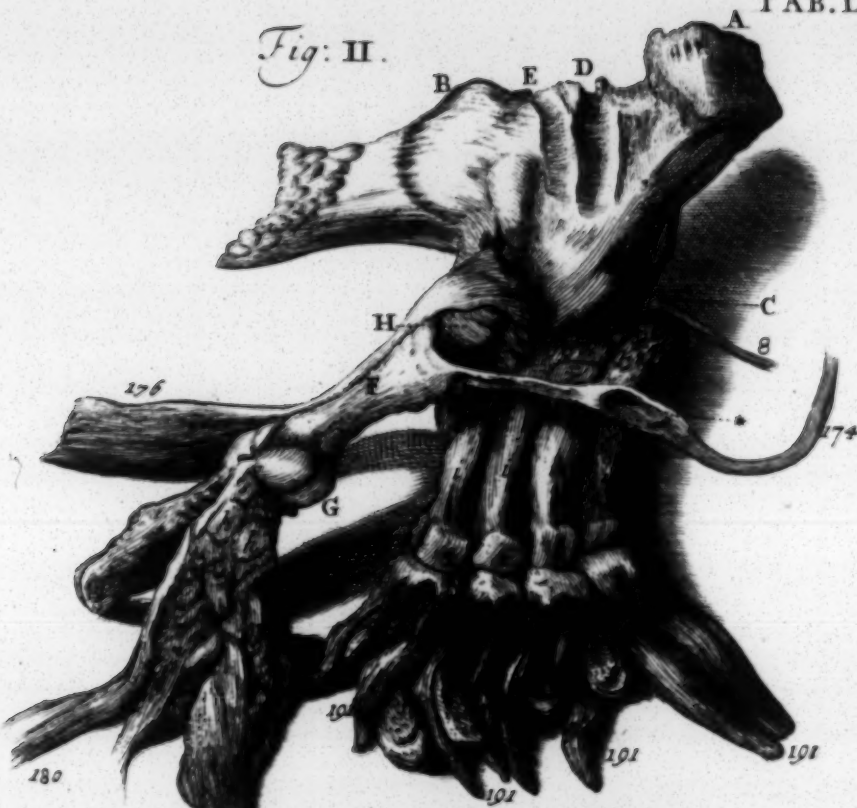
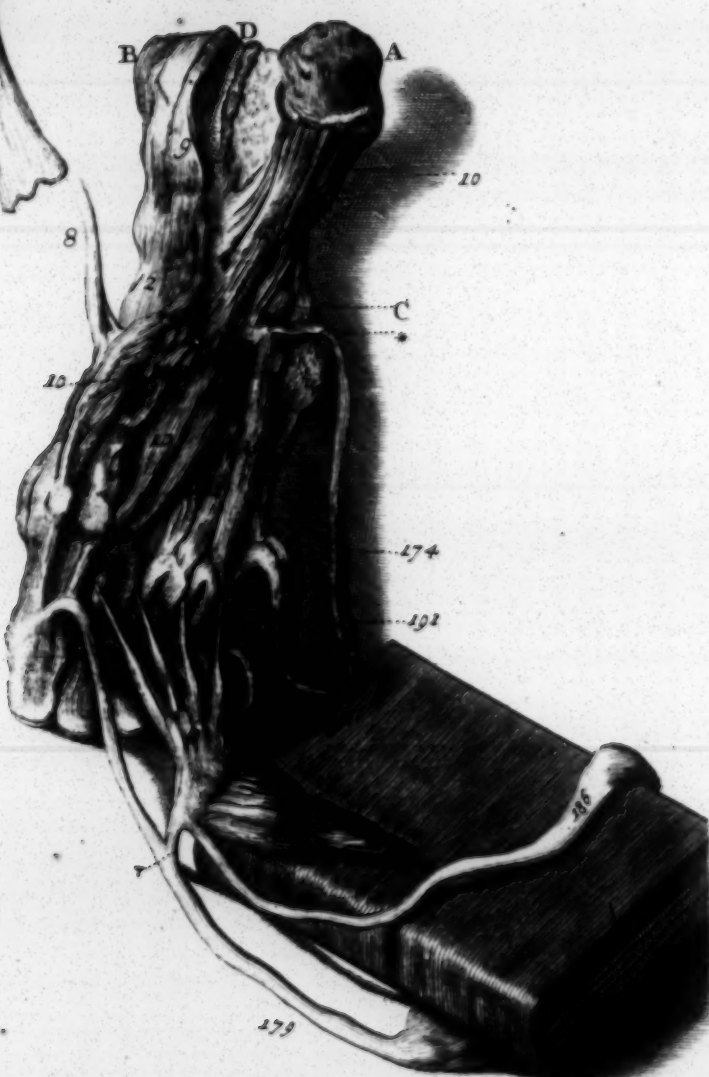


Fig: I.



SYLLABUS MUSCULORUM
E A SERIE
*Qua in Ordinarijs Corporis Humani
Ανατομικῶς Disscantur.*

MUSCULI Abdominis		AURICULÆ	
1	<i>Obliquus</i> { <i>Descendens</i>	38	<i>Attollens</i> } <i>Auriculam</i>
2	{ <i>Ascendens</i>	39	<i>Retrahens</i> }
3	<i>Pyramidalis</i>	<i>Auris Internæ</i>	
4	<i>Pectus</i>	40	<i>Externus</i> }
5	<i>Transversalis</i>	41	<i>Obliquus</i> } <i>Auris</i>
<i>TESTIUM</i>		42	<i>Internus</i> }
6	<i>Cremaster</i>	43	<i>Musculus Stapedis</i>
<i>Penis</i>		<i>Offis Hyoidis</i>	
7	<i>Accelerator Urinæ</i>	44	<i>Sternohyoideus</i>
8	<i>Erector Penis</i>	45	<i>Coracohyoideus</i>
9	<i>Transversalis Penis</i>	46	<i>Stylohyoideus</i>
<i>Clitoridis</i>		47	<i>Mylohyoideus</i>
10	<i>Erector Clitoridis</i>	48	<i>Geniohyoideus</i>
11	<i>Sphincter Vaginæ</i>	<i>LINGUÆ</i>	
<i>Vesicæ Urinæ</i>		49	<i>Genioglossus</i>
12	<i>Detrusor Urinæ</i>	50	<i>Ceratoglossus</i>
13	<i>Sphincter Vesicæ</i>	51	<i>Styloglossus</i>
<i>ANI</i>		52	<i>Basioglossus</i>
14	<i>Sphincter</i> } <i>Ani</i>	<i>Uvulæ</i>	
15	<i>Levator</i> }	53	<i>Glossostaphylinus</i>
<i>FRONTIS et Occipitis</i>		54	<i>Sphenostaphylinus</i>
16	<i>Occipitalis</i>	55	<i>Pterygostaphylinus</i>
17	<i>Frontalis</i>	<i>Faucium</i>	
<i>Genarum et Labiorum</i>		56	<i>Stylopharyngeus</i>
18	<i>Quadratus Genæ</i>	57	<i>Oesophagus</i>
19	<i>Buccinator</i>	58	<i>Vaginalis Gulae</i>
20	<i>Zygomaticus</i>	<i>LARYNGIS</i>	
21	<i>Elevator</i> }	59	<i>Sternothyroideus</i>
22	<i>Depressor</i> } <i>Labiorum</i>	60	<i>Hyothyroideus</i>
23	<i>Orbicularis</i> }	61	<i>Cricothyroideus</i>
24	<i>Elevator Labij Superioris</i>	62	<i>Cricothyroideus</i> { <i>Posticus</i>
25	<i>Depressor</i> } <i>Labij Inferioris</i>	63	{ <i>Lateralis</i>
26	<i>Elevator</i> }	64	<i>Thyroarytænoideus</i>
<i>PALPEBRARUM.</i>		65	<i>Arytænoideus</i>
27	<i>Orbicularis Palpebrarum</i>	<i>Maxillæ Inferioris</i>	
28	<i>Aperiens Palpebram Rectus</i>	66	<i>Temporalis</i>
<i>Oculi</i>		67	<i>Masseter</i>
29	<i>Obliquus</i> { <i>Superior</i>	68	<i>Digastricus</i>
30	{ <i>Inferior</i>	69	<i>Pterygoideus</i> { <i>Internus</i>
31	<i>Elevator</i> }	70	{ <i>Externus</i>
32	<i>Depressor</i> }	<i>Thoracis Anterioris</i>	
33	<i>Adductor</i> } <i>Oculi</i>	71	<i>Serratus</i> { <i>Minor</i> } <i>Anticus</i>
34	<i>Abductor</i> }	72	{ <i>Major</i> }
<i>NASI</i>		73	<i>Subclavius</i>
35	<i>Elevator Alæ Nasi</i>	74	<i>Scalenus</i> { <i>Primus</i>
36	<i>Dilatator Alæ Nasi</i>	75	{ <i>Secundus</i>
37	<i>Elevator et Labij Superioris</i>	76	{ <i>Tertius</i>
37	<i>Constrictor Alæ Nasi</i>	77	<i>Triangularis</i>
		78	<i>Diaphragma</i>
		79	<i>Intercostales Interni</i>

80 *Cor* SCAPULÆ.
81 *Cucullaris*
82 *Rhomboides*
83 *Levator Scapulæ*
Thoracis Posterioris
84 *Serratus* { *Superior* } *Posticus*
85 { *Inferior* }
86 *Sacro-lumbalis*
87 *Intercostales Externi*
CAPITIS et COLLI
88 *Splenius*
89 *Complexus*
90 *Rectus* { *Major*
91 { *Minor*
92 *Obliquus* { *Superior*
93 { *Inferior*
94 *Mastoidæus*
95 *Rectus Internus* { *Major*
96 { *Minor*
97 *Rectus Lateralis*
98 *Longus Colli*
99 *Spinalis Colli*
100 *Interspinales*
101 *Transversalis*
Dorsi et Lumborum
102 *Dorsi Longissimus*
103 *Quadratus Lumborum*
104 *Semispinatus*
105 *Sacer*
106 *Musculus Coccygis*
Humeri
107 *Pectoralis*
108 *Deltoides*
109 *Supraspinatus*
110 *Infraspinatus*
111 *Teres* { *Minor*
112 { *Major*
113 *Latissimus Dorsi*
114 *Coracobrachialis*
115 *Subscapularis*
CUBITI
116 *Biceps*
117 *Brachialis Internus*
118 *Gemellus*
119 *Brachialis Externus*
120 *Anconæus*
Palmae Manus
121 *Palmaris* { *Longus*
122 { *Brevis*
Digitorum et Pollicis
123 *Perforatus*
124 *Perforans*
125 *Lumbricales*
126 *Extensor Digitorum Communis*
127 *Interossei Manus*
128 *Indicator*
129 *Abductor Indici*
130 *Minimi Digiti Extensor*
131 *Abductor Minimi Digiti*
132 *Flexor 3^{us} Internodij Pollicis*
133 *Abductor Pollicis*

134 *Flexor 1^{us} & 2^{us} Internodij Pollicis*
135 *Adductor Pollicis*
136 { *1^{us}*
137 { *2^{us}* *Internodij Pollicis*
138 { *3^{us}*
CARPI
139 *Flexor Carpi* { *Radialis*
140 { *Ulnaris*
141 *Extensor Carpi* { *Radialis*
142 { *Ulnaris*
Radij
143 *Pronator Radij* { *Teres*
144 { *Quadratus*
145 *Supinator Radij* { *Longus*
146 { *Brevis*
FEMORIS
147 *Psoas* { *Parvus*
148 { *Magnus*
149 *Iliacus Internus*
150 *Pectineus*
151 *Gluteus* { *Major*
152 { *Medius*
153 { *Minor*
154 *Pyramidalis*
155 *Vastus Medialis*
156 *Quadratus Femoris*
157 *Obturator Externus*
158 *Triceps*
Tibiæ
159 *Membranosus*
160 *Sartorius*
161 *Gracilis*
162 *Biceps*
163 *Semimembranosus*
164 *Semimembranosus*
165 *Popliteus*
166 *Rectus*
167 *Castus* { *Externus*
168 { *Internus*
169 *Crureus*
Pedis
170 *Tibialis Anticus*
171 *Gastrocnemius*
172 *Plantaris*
173 *Soleus*
174 *Peronæus* { *Primus*
175 { *Secundus*
176 *Tibialis posterior*
Digitorum Pedis
177 *Extensor Pollicis* { *Longus*
178 { *Brevis*
179 *Flexor Pollicis* { *Longus*
180 { *Brevis*
181 *Adductor* { *Pollicis*
182 *Abductor* { *Pollicis*
183 *Extensor Digitorum Pedis* { *Longus*
184 { *Brevis*
185 *Perforatus*
186 *Perforans*
187 *Lumbricales*
188 *Abductor Minimi Digiti*
189 *Transversalis Pedis*
190 *Flexor Minimi Digiti*
191 *Interossei Pedis*